

**PETROLEUM REFINING LISTING DETERMINATION**  
**PROPOSED RULE RESPONSE TO COMMENT DOCUMENT**

**Part III**

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Office of Solid Waste  
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## IV. RESIDUAL-SPECIFIC COMMENTS

### A. CRUDE OIL TANK SEDIMENT

**The Agency requested comment on its proposed decision not to list crude oil storage tank sediment and other factors that may affect its final decision.**

#### 1. General

**Comment 1:** A number of commenters expressed their support of EPA's proposal not to list crude oil storage tank (COST) sediment as hazardous waste. (Amerada Hess, 00027; API, 00046; ARCO, 00023; BP Oil, 00015; Caufield, 00009; Coastal, 00048; Heritage, 00010; Mobil, 00033; NPRA, 00015; Phillips, 00055; Sun, 00034; Total, 00039; Valero, 00051; WIRA, 00048)

API listed three specific reasons why the proposal not to list was appropriate:

- EPA selected the correct management scenarios for evaluations (see Section IV.A.5, Comment 1 of this response to comment document);
- COST sediments that meet the TC are adequately regulated and therefore should not be used in the risk assessment (see Section IV.A.9, Comment 1 of this response to comment document); and
- The proposal was consistent with the Agency's listing criteria (see response below ).

API suggested additional factors that support the no list determination:

- The land treatment analysis that assumed no run-on/run-off controls showed risk in the presumptive no-list range (see Section IV.A.6, Comment 1 of this response to comment document);
- Risks for landfills would be reduced if only non-TC wastes were used in the risk assessment (see Section IV.A.9, Comment 1 and Section IV.C.2, Comment 4 of this response to comment document);
- Risk was overestimated because biodegradation was not considered in ground water (see Section IV.A.4, Comment 1 of this response to comment document); and
- Population risks were infinitesimal and should be considered (see Section IV.A.7, Comments 1 to 4 of this response to comment document).

**Response:** The Agency acknowledges the comments and responds to the individual elements of the comments elsewhere in this section as noted above. EPA initially proposed not to list this residual as hazardous waste citing the borderline risks identified with landfilling crude oil storage tank sediment. After completing additional analyses as a direct response to comment, this residual showed increased risk. The Agency therefore is listing crude oil storage tank sediment as K169.

**Comment 2:** EDF noted that in the version of the proposal transmitted to OMB, EPA proposed

to list the waste as hazardous, only to acquiesce to OMB and reverse its position during interagency deliberations. See F-95-PRLP-S0002 (the Redlined Version of the Preamble) in the rulemaking record. The commenter suggested that perhaps this “forced” reversal explains the inadequate rationale for the no list proposal.

**Response:** The changes noted by the commenter were not a result of EPA being forced to reverse its decision, but instead reflect the borderline nature of the risk associated with crude oil storage tank sediment. At the time of proposal, EPA was not sure that the evidence adequately supported an unqualified proposal, and therefore presented the results of the risk assessment for public comment with the expectation that public comment would further the discussion and perhaps bring new data to light to more clearly support a list or no list decision. After considering the commenters’ varied concerns and revising the risk assessment and various analyses, EPA has concluded that there was in fact a case for listing this residual.

## 2. Scope of Listing

**Comment 1:** EPA’s description of crude oil storage tank bottom sediment does not adequately define the point of generation for the waste. The point of generation for this waste is after oil recovery (de-oiling) is completed and after a decision has been made to dispose of the material (or to manage the material in a non-exempt management practice, such as burning for energy recovery). (API, 00046; Phillips, 00055; Sun, 00034)

**Response:** Note that this comment is also relevant to Clarified Slurry Oil (CSO) tank sediment and filter solids, although the issue was not specifically raised for K170. Once the sediment is removed from the tank or filter system, the residual destined for discard is the listed hazardous waste. In the case of oil recovery operations which coincide with the removal of the oil bearing residual from a tank or process unit, these operations are viewed by the Agency to be part of normal petroleum refining and not subject to RCRA permitting. In the final rule, the Agency has also specifically excluded oil-bearing residuals that go back into the refinery process. Furthermore, the oil recovered from these operations is also excluded. However, in the final rule EPA has decided to retain the “de-oiled” residual produced from K169 and K170 as hazardous waste, if discarded. See Section II of this response to comment document for a full discussion of this issue.

**Comment 2:** The commenters agree that the listing evaluation should be limited to crude oil tank sediment generated from storage tanks at petroleum refineries. EPA should not broaden the scope to include affiliated tank storage areas owned or under contract to a refinery. This is a vague and unnecessary description that adds tanks that have not been evaluated. Only tanks physically in and operated by the refinery should be subject to the listing evaluation. (API, 00046; Mobil, 00033; Phillips, 00055; Sun, 00034)

**Response:** Consistent with the proposal, it is EPA’s intent that the listing for crude oil storage tank sediment from refinery operations be limited in scope to wastes generated from tanks that are

either on the refinery site, or at tank storage areas owned or under contract to the refinery. Thus, the listing does not apply to storage tanks upstream at exploration and production sites, or associated with pipelines or other crude oil transportation conveyances. EPA's meaning with respect to the term "affiliated" was to extend the scope of the listing to all tanks containing crude oil that are owned by the refinery and used in refinery operations. (60 FR 57764)

3. Use of the TCLP and the TC

[Comments related to the use of TCLP for this and other wastes are discussed in Section III.H; comments related to the regulatory coverage provided by the TC rule are discussed below in Section IV.A.9.]

4. Biodegradation

**Comment 1:** EPA did not consider the biodegradation of benzene for crude oil storage tank bottom sediment in its risk estimates for groundwater. As a result EPA's risk estimates for benzene in groundwater are likely overestimated. (API, 00046; Amerada Hess, 00027; ARCO, 00023; Caufield Enterprises, 00009; Mobil, 000033; Phillips, 00055)

The risks to consumers of groundwater associated with releases of benzene from off-site Subtitle D landfills are limited. Only about 10 percent of refinery crude tank bottoms were sent to such landfills. It has become well known that biodegradation of benzene is the rule, rather than the exception, in subsurface environments. It is the dominant natural attenuation mechanism that limits the transport in groundwater. These rates are typically between 0.01 and 0.001/d. Consequently, any risks associated with leaching of benzene from Subtitle D landfills and the subsurface transport of this benzene to drinking water wells are greatly overstated because this natural attenuation was not taken into account. (ARCO, 00023; Mobil, 00033)

**Response:** Section III.D of this document contains EPA's reasoning regarding its decision not to consider biodegradation in the ground-water pathway analysis. The revised risk assessment (see Supplemental Background Document; NonGroundwater Pathway Risk Assessment in the docket for the April 8, 1997 NODA), however, incorporated benzene biodegradation more fully into the indirect pathway analysis.

5. Risk Assessment - General

**Comment 1:** The commenters expressed their support of the management scenarios chosen by EPA for risk assessment purposes (API, 00046; Sun, 00034),

**Response:** EPA acknowledges the commenters' support.

**Comment 2:** The commenter argued that EPA should have evaluated the use of this waste as landfill cover. (EDF, 00036)

Crude oil tank sludge and potentially other refinery wastes are used as landfill cover<sup>145</sup>. EPA did not evaluate the risks posed by this practice because the volumes reported in 1992 were “minimal” and “unlikely” to present risk.<sup>146</sup> EPA’s assumption throughout the listing determination that the volumes and associated waste management practices reported in 1992 are forever fixed and completely reflect potential mismanagement scenarios violates RCRA, the Agency's listing policy, previous practice, and common sense.

Furthermore, EPA's bold conclusion that the use of tank sludges and other wastes as daily landfill cover is unlikely to pose risks cannot be supported by its own analyses. Where no daily cover at an onsite landfill is assumed (the most relevant scenario if the waste is the daily cover), the predicted cancer risks associated with crude oil tank sludge are in the  $10^{-3}$  to  $10^{-4}$  risk range for subsistence farmers and fishers; and high noncancer risks from mercury exposure are estimated for subsistence fishers as well.<sup>147</sup>

**Response:** EPA notes that the waste management method was only reported by one refinery in 1992 for crude oil tank sediment. EPA determined that one facility managed its crude oil tank sludge as “cover for onsite landfill” in 1992<sup>148</sup>. In this particular case, the waste was mixed with soil, weathered, and then used as cover. EPA also found that the landfill no longer accepts wastes. The fact that only one facility was found to conduct this activity, and has since discontinued the practice, does not lend credence to the commenter’s opinion that such practices could become more widespread in the future.

In addition, the results quoted by the commenter are bounding (i.e., worst case screening assumptions used), not the two-high end parameter modeling results (i.e., risk assumptions used to support listing determinations) estimates. Bounding results were used in the early stages of the risk assessment process to screen out management scenarios from further consideration by setting many modeling parameters to their high ends. If no risk was shown with many parameters set at their high ends, no risk would be shown at the two-high end model, which is used to support listing determinations. These bounding results also reflect the improper use of the bioaccumulation factor for mercury that was inadvertently entered into the model as a BSAF (bioaccumulation from sediment factor) instead of a BAF (bioaccumulation from the water column) as appropriate. This caused the estimated bounding hazard quotient (HQ) for mercury to be too high by several orders of magnitude. Thus EPA believes that the bounding analysis grossly overestimated risks.

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<sup>145</sup>One refinery also reported using 2,930 MT of FCC fines as a cover for its onsite land farm in 1992.

<sup>146</sup>1995 Listing Background Document at 28.

<sup>147</sup>1995 EPA Non-Groundwater Risk Assessment, Appendix J at 24.

<sup>148</sup>1992 RCRA 3007 Survey for Sinclair Oil, Sinclair, WY, Facility 182.



**Comment 3:** EPA has not properly characterized the risks posed by crude oil tank sludge. In proposing not to list this waste, EPA committed a large number of errors and made numerous indefensible assumptions. As a result, EPA has grossly understated the risks posed by disposal of this waste outside Subtitle C. Correcting these deficiencies would reveal a risk level unequivocally warranting a hazardous waste listing. The specific areas identified by the commenter as deficiencies are described further in Comments 4 through 12. (EDF, 00036)

**Response:** Due to the borderline nature of crude oil storage tank sediment, EPA proposed not to list this residual as hazardous waste. However, after completing additional analyses in direct response to comments, this residual showed increased risk. The Agency is therefore promulgating the listing for crude oil storage tank sediment as K169. The commenter's specific concerns regarding EPA's risk assessment for this waste stream and the Agency's responses are provided below in Comments 4 through 12.

**Comment 4:** EPA failed to model the use of this waste as a landfill cover. (EDF, 00036)

**Response:** As discussed immediately above in response to Comment 2, the Agency asserts it is unnecessary to evaluate the pathway of use as landfill cover.

**Comment 5:** EPA used TCLP results as the input values to the landfill groundwater modeling despite the acknowledged ineffectiveness of the procedure for oily wastes. (EDF, 00036)

**Response:** As discussed in detail in Section III.H of this response to comment document, EPA remains convinced that it is appropriate to use the TCLP to characterize these residuals and to use TCLP results as input to the ground-water model.

**Comment 6:** The Agency failed to account for the effects of co-disposal with other refinery and industrial wastes, and used improperly low volume assumptions in its modeling. (EDF, 00036)

**Response:** EPA evaluated the potential effects of co-disposal of crude oil tank sediment with other refinery residuals, as described in Section III.I, Comment 3. The result of this analysis was noticed in the April 8, 1997 NODA. The maximum groundwater high end risk for this residual alone (without co-disposal) was  $3 \times 10^{-5}$ <sup>149</sup>, while the comparable risk for the co-disposal scenario modeling off-site landfills showed lower benzene-associated risks of  $8.9 \times 10^{-6}$  and  $3.8 \times 10^{-6}$  for co-disposal with and without hydrocracking catalysts, respectively<sup>150</sup>. Similarly, for the non-groundwater risk analysis, the maximum high end risk for this residual alone (without co-disposal)

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<sup>149</sup>See Table II of the April 8, 1997 NODA.

<sup>150</sup>See Table 5.7 of the "Supplemental Background Document; Groundwater Pathway Risk Analysis", Petroleum Refining Process Waste Listing Determination March, 1997.

was  $4 \times 10^{-7}$ <sup>151</sup>, while the comparable risks for the co-disposal scenario modeling on-site land treatment units for the subsistence farmer scenario showed the same risk level<sup>152</sup>. Although EPA does not believe that consideration of potential co-disposal risks alone supports listing this residual as hazardous, the results of additional analyses conducted in direct response to comments on other issues showed increased risk attributable to this residual. The Agency will therefore list crude oil storage tank sediment as K169.

**Comment 7:** EPA failed to account for the free-phase flow of contaminants. (EDF, 00036)

**Response:** EPA concluded that free phase flow is unlikely with these residuals as discussed in Section III.H with respect to the appropriateness of the TCLP and Section III.K with respect to the Agency's modeling of potential NAPL formation. It is particularly important to note that none of the six crude oil storage tank sediment record samples were found to exhibit multi phase behavior. From a practical perspective, refineries are, by the nature of their business, geared toward maximizing the extraction of valuable fuel products (e.g., gasoline) from crude oil, and thus have financial incentives to minimize the amount of recoverable crude oil (i.e., free phase oils) that is disposed with the storage tank sediments. These financial incentives are described in the literature where oil recovery is reported to cover the cost of tank cleanouts.<sup>153</sup>

**Comment 8:** The Agency improperly assumed land treatment units managing this waste would always be equipped with run-off controls operating at 50% efficiency. (EDF, 00036)

**Response:** This issue is discussed in Section III.G of this document. A discussion of the distribution of values considered in and the results of this analysis are presented in the Uncertainty Analysis: NonGroundwater Pathway Risk Assessment.

**Comment 9:** EPA inappropriately assumed a small waste unit area size for offsite landfills in its evaluation of dissolved phase groundwater flow, and improperly assumed a short active life for all landfills. (EDF, 00036)

**Response:** As covered in greater detail in Section III.J of this document, the Monte Carlo groundwater risk assessment modeling has been adjusted to improve its consideration of off-site landfill area. Section III.L discusses EPA's re-evaluation of the landfill active life assumptions.

**Comment 10:** The Agency failed to consider risks to subsistence farmers and fishers. (EDF,

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<sup>151</sup>See Table III of the April 8, 1997 NODA.

<sup>152</sup>See Table 15.2 of the "Supplemental Background Document; NonGroundwater Pathway Risk Assessment; Petroleum Process Waste Listing Determination," March 20, 1997.

<sup>153</sup>Rhodes, A. Oil & Gas Journal. "New Process Effectively Recovers Oil from Refinery Waste Streams." August 15, 1994.

00036)

**Response:** See response to comments 1 and 2 in Section III.M of this response to comment document.

**Comment 11:** The Agency failed to consider risks from dermal and inhalation exposure to groundwater contaminants such as benzene. (EDF, 00036)

**Response:** EPA responds to this comment in general in Section III.O of this document.

**Comment 12:** The Agency failed to sum risks across groundwater and non-groundwater pathways. (EDF, 00036)

**Response:** See Section III.R of this document.

**Comment 13:** Accounting for two of the risk assessment deficiencies - the improper use of the TCLP results and inclusion of the dermal and inhalation risks associated with benzene and other contaminants in the waste - would elevate EPA's predicted risk estimates to the presumptive listing level of  $10^{-4}$  or higher. When all the flaws in the risk assessment methodology are addressed, and EPA truly characterizes the risks posed by crude oil storage tank sludge, the risk levels would vastly exceed presumptive listing levels. (EDF, 00036)

**Response:** After reviewing all of the public comments, the risk assessment was modified to address those comments which the Agency agreed had merit and could be addressed by currently available risk assessment tools. After completing additional analyses as a direct response to comment on the NODA, this residual showed increased risk. The Agency will therefore list crude oil storage tank sediment as K169. These revisions are described in the April 8, 1997 NODA and in the docket for today's rule.

**Comment 14:** The average total concentration of benzene in this waste exceeds the comparable concentration of benzene in F037 and F038 that caused those wastes to be listed in 1990. Similarly, the benzo(a)pyrene concentration in crude oil storage tank sludge exceeds the comparable concentration in F038 and K145 which caused those wastes to be listed in 1990 and 1992 and the average total concentration of indeno(1,2,3-cd)pyrene exceeds comparable concentrations in K145 which caused that waste to be listed in 1992. (EDF, 00036)

**Response:** EPA recognizes that this and other residuals characterized in this listing determination contain concentrations of toxicants equal to or greater than previously listed wastes, including the F037 and F038 refinery residuals. Direct comparison of these concentrations to previous listing benchmarks is not an adequate basis for listing given the significant advances in the Agency's risk assessment expertise.

Further, the commenter is implying that EPA should adopt an intrinsic hazard standard, using the

F037/F038 sludge listings as a benchmark. EPA cannot agree with this approach for several reasons. First, advances in risk assessment make it inappropriate to use the sludge listings as the ultimate risk benchmark. Secondly, EPA's approach to risk assessment is grounded in the consideration of multiple factors rather than solely toxicant concentration. EPA carefully assesses waste generation, management and disposal practices to develop a full picture of potential risk, grounding its assessment in real world practices. Thus, EPA's decision to finalize the listing for crude oil tank sediment is not based on comparisons of toxicant concentrations in wastes listed in 1990, but rather on the basis of current, state-of-the-art risk assessment.

**Comment 15:** The risks to human health and the environment posed by the mismanagement of crude oil storage tank sludge vastly exceed those predicted by EPA in its proposal, due to substantial risk assessment deficiencies. Furthermore, even at the risk levels suggested in the proposal, the waste warrants listing based upon the factors articulated by EPA in its listing determination policy. First, the waste characterization is uncertain since it substantially understates the risks posed by crude oil storage tank sludge insofar as TCLP results are used. Second, the risk assessment is uncertain because it vastly underestimates potential risks due to unsupported assumptions regarding management practices and the failure to consider important exposure pathways and receptors. Third, EPA completely failed to consider co-occurrence or codisposal with other wastes, and the resulting aggregation of constituents and potential for free phase flow. Fourth, other regulatory programs will not address the risks posed by the mismanagement of these wastes. (EDF, 00036)

**Response:** The EPA has considered each of the commenter's four arguments claiming that EPA's risk assessment and decision making understates the potential hazards associated with crude oil tank sludge. The Agency's specific responses are provided below in comments 15a through 15d. In general, however, EPA notes that it has decided to list this waste, even if the Agency does not agree with many of the suggestions made by the commenters.

**Comment 15a:** The waste characterization is uncertain since it substantially understates the risks posed by crude oil storage tank sludge insofar as TCLP results are used. (EDF, 00036)

**Response:** The Agency determined it is appropriate to use the TCLP for the samples collected for this residual. A complete discussion of the appropriateness of the use of the TCLP is provided in Section I.C of the NODA Response to Comment Document.

**Comment 15b:** The risk assessment is uncertain because it vastly underestimates potential risks due to unsupported assumptions regarding management practices and the failure to consider important exposure pathways and population receptors. (EDF, 00036)

**Response:** Risk assessment assumptions of concern to the commenter are addressed in response to Comment 3, above. The Agency agrees that there is uncertainty associated with the results of the risk assessment. An uncertainty and variability analysis has been performed in support of the nongroundwater risk assessment for this rule. A detailed discussion of the qualitative and

quantitative aspects of this analysis are presented in the Uncertainty Analysis: NonGroundwater Pathway Risk Assessment, 1998. A Monte Carlo analysis of the groundwater risks from landfills has also been completed, as discussed in the NODA.

**Comment 15c:** EPA completely failed to consider co-occurrence or codisposal with other wastes, and the resulting aggregation of constituents and potential for free phase flow. (EDF, 00036)

**Response:** As described in the April 8, 1997 NODA (see also comment 3 in Section III.I), EPA has conducted a full assessment of co-disposal with other refinery wastes. This analysis showed that the co-disposal risk associated with units reported to accept crude oil tank sediment in 1992 is comparable to the risk associated with assessment of the crude oil tank sediment alone.

**Comment 15d:** Other regulatory programs will not address the risks posed by the mismanagement of these wastes. (EDF, 00036)

**Response:** The Agency is listing crude oil storage tank sediment as K169 to address the risks posed by these wastes.

#### 6. Risk Assessment - Land Treatment

**Comment 1:** The risk estimates for land treatment of crude oil storage tank bottom sediment when run-on/run-off controls are considered is academic because these risk estimates are essentially in the presumptive “no list” range (i.e., the total carcinogenic risk is equal to or less than  $1 \times 10^{-6}$ ), even when no controls are assumed. (API, 00046; NPRA, 00015; Phillips, 00055)

**Response:** The revised risk estimates for land treatment, presented in the April 8, 1997 NODA, are all less than  $1 \times 10^{-6}$ , with a maximum risk for  $4 \times 10^{-7}$  found for the on-site land treatment unit/subsistence farmer scenario. However, after completing additional analyses as a direct response to comment on other issues, this residual showed increased risk via the landfill scenario.

**Comment 2:** The pathway analysis conducted by EPA for erosion/runoff from land treatment sites is faulty and does not produce exposure results that can be used to justify the listing of COST. (API, 00046; Valero, 00051)

**Response:** As discussed in Section III.G, EPA believes that its revised integrated settings approach presented in detail in the April 8, 1997 NODA (62 FR 16747) for addressing soil erosion from land treatment units is appropriate and reasonable.

**Comment 3:** A commenter uses a land treatment unit which meets the Minimum Functional Standards required by Washington State which includes run-on/run-off controls, liners and a leachate collection system. These controls are very effective at eliminating off-site releases and are more the norm, rather than an exception, in other states. Consequently, it is likely that the

risks from this source were overstated. (ARCO, 00023)

**Response:** EPA notes that while some states have established minimum standards for Subtitle D units, such as the controls required by the state of Washington, many states do not have regulations on run-on/run-off controls.<sup>154</sup> However, the Listing Program's mandate to consider potential mismanagement scenarios clearly does not rely on assumption of the best controls, but rather must more closely evaluate the weakest plausible management scenarios. In the case of land treatment units, this includes the potential for no or minimal run-on or run-off controls in many states, reflecting the lack of national minimum standards. As part of the analysis described in the April 8, 1997 NODA, EPA reassessed the LTUs and waste volumes used in the modeling effort. Those units determined to be Subtitle C units (and thus required to have run-on/run-off controls, §264.273) were eliminated.

## 7. Other Miscellaneous Considerations

**Comment 1:** Population risks associated with landfilling of crude oil storage tank sediment should also be considered. The potentially impacted populations as calculated by EPA are infinitesimally small. The insignificant public health impact supports a decision not to list crude oil storage tank sediment. (API, 00046; Phillips, 00055)

**Response:** EPA's primary response to comments regarding population risks can be found in Section IV.B of the NODA Response to Comments Document in the docket.

**Comment 2:** The population exposed to benzene plumes is overestimated. Several recent studies show that benzene plumes rarely reach one mile in length. Therefore, the actual number of individuals potentially exposed is substantially less than the number calculated by the Agency and the risk estimate for this residual is consequently inflated. (API, 00046)

**Response:** The population within a 1 mile radius was used as a starting point in the analysis, in order to provide an upper bound for the population that might potentially be exposed. The purpose of the population exposure and risk analysis was to estimate the actual number of individuals that might be exposed at levels exceeding a  $10^{-6}$  risk. The results of the analysis are consistent with the commenter's statement about the extent of benzene plumes. Table 4.10 in the Background Document for the Groundwater Pathway Analysis (U.S. EPA, 1995) shows that the majority of exposures exceeding the HBN occur within the first 400 meters (quarter mile) from a waste unit, and that the population at distances greater than a half-mile contribute very little to the estimated total exposed population. In the case of benzene exposures associated with landfilling of crude oil tank sediment, the calculation shows that all exposures above the HBN would occur within 400 meters from the waste unit (Table 4.10). Since these population risk estimates came out low and the Agency based its decision to list the wastes affected by this determination

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<sup>154</sup>“Communications with State Authorities on Requirements for Land Treatment Units,” EPA, 1995 (F-95-PRLP-S0019).

primarily on the significant individual risk estimates and other factors, the Agency did not attempt to further refine the population risk estimates.

**Comment 3:** Annualized cancer incidence is overestimated. Equation 10 in the 1995 Background Document for Groundwater Pathway Analysis results in overestimating of the annualized cancer incidence for this residual. (API, 00046)

**Response:** Equation 10 in the Background Document for the Groundwater Pathway Analysis (EPA, 1995) estimates the annualized cancer incidence as the sum of the individual risk times population size, divided by the average residence time (exposure duration) of 9 years. Use of this equation is consistent with the calculation of the individual cancer risk on page 35 of the Background Document for the Groundwater Pathway Analysis, which is also based on an average exposure duration of 9 years. The commenter's argument that replacement populations will be exposed to less than the nine year average peak concentrations is consistent with a one-time release of the contaminants. In fact, the scenario considered in the analysis is that of long term release from a landfill, which does result in an approximately steady-state plume, in which multiple population cycles are exposed at the same level. Since these population risk estimates came out low and the Agency based its decision to list the wastes affected by this determination primarily on the significant individual risk estimates and other factors, the Agency did not attempt to further refine the population risk estimates.

**Comment 4:** The enormous economic cost of listing COST sediment would vastly outweigh the minimal potential benefits. (API, 00046)

**Response:** EPA acknowledges the commenter's concern, but reminds the reader that cost is not a required consideration in the hazardous waste listing determination process by either statute or regulation. Further, as note in the proposed rule, the cost of regulating this waste as hazardous will be off-set to some extent by the exclusion EPA is promulgating for oil-bearing wastes (see 60 FR 57793).

#### 8. Potential Consequences if Listed

**Comment 1:** There is the possibility, depending on how the exclusion for oil-bearing materials is written in the final rule, that refiners will end up in the same situation as currently exists with other listed refinery hazardous wastes such as API separator sludge (K051). If a west coast refinery is unable to recycle these listed wastes to their coker, their only option has been to haul these materials thousands of miles to either an incinerator and cement kiln due to land disposal restrictions. (ARCO, 00023)

**Response:** The EPA agrees with the commenter. If a secondary oil bearing residual, which would be a listed hazardous waste if discarded, cannot be recycled in compliance with the provisions of the exemption, then the residual is hazardous waste subject to all RCRA requirements including applicable land disposal restrictions. However, the Agency notes that the exemption has been

expanded to allow the refinery to return such materials to anywhere in the refining process including but not limited to the coker. In this manner, the refinery has the greatest flexibility to utilize oil bearing materials effectively.

9. Use of TC: The Agency requested comments on whether the TC effectively captures wastes of concern.

**Comment 1:** The use of the toxicity characteristic (TC) adequately regulates potential risks, and therefore, makes listing of the refining process residuals unnecessary. (Amerada Hess, 00027; API, 00046; Ashland, 00020; BP Oil, 00019; Caufield, 00009; Coastal, 00048; Exxon, 00035; Heritage, 00010; Mobil, 00033; NPRA, 00015; Pennzoil, 00053; Total, 00039; Valero, 00051; WIRA, 00048)

**Response:** The commenters argue that because the constituents of concern are part of the TC characteristic no regulation is necessary. In contrast, other commenters have argued that because the wastes are frequently TC they should be listed. The Agency's decision has not been based on either position, but rather a weight of the evidence.

**Comment 2:** The Agency solicits information that might demonstrate the ineffectiveness of the Toxicity Characteristic test for benzene and thus justify a listing in spite of the obvious adverse cost/benefit relationship. (Mobil, 00033)

**Response:** Comments received by EPA argued against the effectiveness of the TCLP in properly identifying these wastes as TC hazardous. However, no definitive new data regarding the effectiveness of the TC were submitted. After completing additional risk analyses in response to comment, EPA found that this residual showed sufficient risk to support listing as hazardous waste.

**Comment 3:** The qualities of crude oil, including the benzene content, vary greatly, therefore no single crude oil storage tank sediment is representative of this residual stream. Because of its variability, crude oil tank sediment is precisely the type of waste stream that is best regulated only if it exhibits hazardous characteristics. (WIRA, 00048)

**Response:** EPA agrees that this residual exhibits variability, but is not relying on the TC to control risks that are otherwise listable. After completing additional risk analyses in response to comment, EPA found that this residual showed sufficient risk to support listing as hazardous waste. Additionally, the Agency's waste characterization shows that this residual does have the potential to exhibit the toxicity characteristic. However, as noted above, EPA believes that the potential variability in this waste may make gathering representative samples in all cases somewhat challenging, due to the varied oil content and the manner in which the tank sediments are removed and deoiled.

EPA recognizes that the characteristics of crude oil vary significantly as measured by a variety of



parameters, including sulfur, heavy metals, paraffins, API gravity, etc. These parameters may have an impact on the potential hazards associated with crude oil storage tank sediment. Some refineries operate with a relatively fixed slate of crude (e.g., only sweet crudes) and these facilities may have sufficient historical information to know whether or not their sludges consistently exhibit a characteristic. Many refineries, however, use a variety of crudes and optimize their operating practices to reflect the crude mix available at any given time. These refineries process many different types of crudes through the same storage tanks, making prediction of sludge hazardousness difficult. Furthermore, the variability in this waste appears to exist even within wastes removed from the same tank. EPA's sampling visits indicate that this waste may form in layers in the tank, such that it is not homogeneous when removed and processed. During tank cleanout, some of the oily sediment initially removed from the tank is often deoiled (e.g., via centrifuging), but other more viscous layers may not be (see Listing Background Document for the 1992-1996 Petroleum Refining Listing Determination, October 1995). Thus, even if a facility attempts to perform the TCLP test in good faith, sampling such a material is a difficult challenge and could lead to inaccurate results.

## **B. CLARIFIED SLURRY OIL SEDIMENT**

### **1. Scope of Listing**

**Comment 1:** The Agency needs to clarify whether the proposed listing is limited to tank sediment and in-line filter/separation solids derived just from CSO when it is stored or managed separately or also from all mixtures of CSO with other fuels, regardless of the amount of CSO present in the fuel mixture or its possible relative contribution to the accumulated sediments or filtration/separation solids.

The proposed K170 listing should be limited to CSO before it is blended with other fuels. When CSO constitutes only a minor component in a fuel oil blend, it is not apparent whether tank bottoms or in-line filter/separation solids resulting from such blends would present a risk that justifies including such materials within the proposed K170 listing. The mere presence of CSO in a material cannot be presumed to make wastes that result from the material hazardous. Limiting the proposed K170 listing to materials derived from unblended CSO could raise the concern that de minimis quantities of fuel oils would be added to CSO tanks to avoid RCRA regulation. As an alternative, EPA could set a percentage of CSO that a blended fuel must contain before it falls within the definition of K170. (Amerada Hess, 00027)

**Response:** EPA points out that any sediments derived from CSO or CSO mixtures are considered K170 because of the contribution of the CSO sediment to the ultimate residual (see the “mixture and derived-from” regulations for hazardous waste in 40 CFR 261.3(a)). The Agency anticipates that refiners will use the 6-month period between the final rule date and the effective date to remove “marginal” storage tanks from service for sediment clean out and subsequently use dedicated tank service for CSO storage to minimize the number of tanks generating the listed hazardous waste.

**Comment 2:** EPA apparently intends to include FCC clean out/turnaround sludges within this listing. If EPA intends the final listing to cover such waste streams, then the listing should be revised. However, such an expanded interpretation would have to be justified by the Agency under the listing criteria. The docket presently does not provide this justification. (Amerada Hess, 00027)

**Response:** Throughout the EPA’s industry study, the Agency intended to incorporate clean out/turnaround sludges from in-line particulate removal units within the scope of the CSO sediment definition (see the 1995 Listing Background Document for the 1992-1996 Petroleum Refining Listing Determination at page 43). Furthermore, the comment shows that the public did understand this to be the case. The primary component of these sediments and storage tank sediments is FCC catalyst fines. Samples were collected from storage tanks (three) and an in-line

filter (one).<sup>155</sup> No samples of turnaround sediments were available during the Agency's field investigation, however, several refineries described the removal of sediments from separation units such as hydroclones during turnarounds. EPA has no reason to believe that sludges removed from the hydroclone during turnarounds would not be comparable to sludges removed from in-line filters because the units serve the same purpose. No information was submitted by the commenters to demonstrate that clean out/turnaround sludges differ from storage tank sediments. The Agency therefore continues to use the broader definition of CSO sediments.

EPA does not, however, expect that all residuals generated during FCC turnaround would be classified as K170, but rather only those associated with particulate removal equipment (e.g., hydroclones, in-line filters). This would not include sediments and tars that may accumulate within the distillation columns; EPA did not target these residuals in its information collection activities. EPA examined and is listing only CSO sediments from storage tanks and filters/separation devices that are generated after the FCC process unit.

**Comment 3:** The universe of storage tanks that is covered by the proposed K170 listing must be clarified. The proposed listing leaves unclear which tank farms are "associated with" refineries. Similarly, it is unclear what would constitute an "affiliated tank farm." (Amerada Hess, 00027)

**Response:** The EPA's meaning with respect to the term "affiliated" was to extend the scope of the listing to all tanks containing CSO that are owned by the refinery that produced the CSO. (60 FR 57766, col. 1) This CSO has not yet been sold or transferred to another entity or corporation, and remains the property of the refinery from which it originated. All sediments settling from the CSO prior to sale of the CSO are subject to the hazardous waste listing.

Similarly, once the CSO has been sold or transferred in commerce, it is no longer under control of the producing refinery and the Agency currently has no data on how it is used or stored. Because EPA has no data on whether sediments continue to be generated, and if generated, under what conditions, the Agency does not believe it has sufficient basis to extend the listing definition to include sediments generated after the CSO has been sold or transferred. This issue would need to be dealt with in the context of another listing determination for another industry.

**Comment 4:** The point of generation of the proposed K170 waste stream should be clarified to apply only to releases of accumulated tank bottom sediments and accumulated in-line filter/separation solids and not to releases of oil that may incidentally contain solids which have not yet separated out. (Amerada Hess, 00027)

**Response:** EPA does not intend to regulate as hazardous the CSO itself, only the sediments that are removed from this hydrocarbon product such as those generated in in-line separators and those sediments that gravitate to the bottom of storage tanks. Clarified slurry oil that is

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<sup>155</sup> 1995 Listing Background Document for the 1992-1996 Petroleum Refining Listing Determination, p. 50.

accidentally spilled on the ground may in fact contain particulates that would have settled out as tank sediment, however, the Agency did not address such spills in the proposed rule and, in response to this comment, is clarifying that it does not currently intend to regulate CSO spills as K170. Spills of K170, of course, would be regulated.

## 2. Risk Assessment Issues: General

**Comment 1:** EPA's proposed listing of CSO Tank Sediment is inconsistent with the conclusions drawn when listing determination for other residuals were made. In its assessment of CSO Tank Sediment, EPA found that 80 percent of the CSO Tank Sediment does not pose a risk to human health and the environment. The remaining 20 percent of CSO Tank Sediment, disposed of in off-site land treatment units, was determined to pose risk in the discretionary range, but only after imposing the conservative assumption that such treatment units lack effective run-on/run-off controls when in fact many such units do have effective run-on/run-off controls. Given the preponderance of compounding conservative assumptions employed when developing the risk assessments, it would seem that *common sense* would suggest that those results that yield risks in the discretionary range should be viewed as insufficient to justify a listing, especially if the listing is going to be imposed on the other 80 percent of the residual that the Agency concedes poses no substantial risk. (Mobil, 00033)

### **Response:**

The Agency notes that the revisions to the risk assessment for this residual (including removal of land treatment units with known run-on/run-off controls) demonstrate greater risk for the landfill scenario than were originally described in the proposal. As a result the contingent exemption options are no longer supportable and have been withdrawn in the final rule (see Section V of this response to comment document).

**Comment 2:** The commenter supports EPA's decision not to consider the subsistence farmer and fisherman in the proposed listing determination for CSO sediments.

In its initial risk evaluation, EPA estimated risks to an adult resident, a home gardener, a recreational fisherman, a subsistence fisherman, and a subsistence farmer. However, due to numerous uncertainties (and also negligible risks for both recreational and subsistence fishermen), the subsistence farmer and subsistence fisherman's exposure scenarios were not considered in the proposed listing determination. The commenter commends the Agency on this decision.

For the subsistence farmer and fisherman pathways to be relevant, there must be transport of contaminants over large areas. This requirement is not met for refining process residual land treatment units, which are limited in size and release relatively small volumes of contaminants. The release of small volumes of contamination over a large area of land would result in significant dilution of concentrations. A subsistence farmer would require a much larger area for raising vegetables and domestic animals than a typical residential plot of 0.5 hectare, as EPA recognized

in its assessment. Similarly, subsistence fishing has only been associated with large, highly productive water bodies such as the Columbia River, the Great Lakes, and the Mississippi River. Such water bodies are too large to be significantly affected by releases from a single (small) waste management unit. (API, 00046)

**Response:** The risk assessment does not include the beef, dairy, and fish ingestion pathways because of the lack of credible biotransfer factors for these pathways. If bioaccumulation factors for these pathways were available for PAHs, the Agency would have included them in the risk assessment.

EPA agrees that for the subsistence farmer and fisherman pathways to be relevant, there must be transport of contaminants to the home garden, the agricultural field, and the fishing stream. EPA modeled transport of contaminants from actual sizes of LTUs used to manage petroleum refinery wastes to farms, gardens, and streams using the revised USLE assumptions and ISC3 air model to estimate transport of contaminants. The meteorologic and soil parameters associated with the actual locations of these LTUs were also used in the uncertainty analysis modeling. The size of the agricultural field and garden were estimated as 2,000,000 m<sup>2</sup> (~494 acres) and 5,100 m<sup>2</sup> (~1.1 acres) respectively. When the site specific parameter values were used in the analysis, risks above a level of concern were estimated for the home gardener and farmer from fruit and vegetable ingestion pathways for clarified slurry oil sludge managed in LTUs. These pathways did not rely on the biotransfer factors considered questionable in this analysis.

EPA disagrees that subsistence fishing has only been associated with large, highly productive water bodies such as the Columbia River, the Great Lakes, and the Mississippi River. The fisher scenario may be associated with any fishable stream. The streams modeled in the risk assessment are the streams reported by the industry as nearest to their facilities. These are not very small streams but are medium to large stream (stream orders 3-5 or 6-8). The streams modeled in this risk assessment are capable of supporting an individual fisher and have been appropriately selected and modeled for water column and sediment concentrations of constituents of concern. The term “subsistence fisher” is used to characterizes any individual who consumes fish at high rates<sup>156</sup>. This category as defined by Ebert et al. (1996) includes:

- individuals with low income who rely on catching fish for dietary needs
- native peoples who have cultural traditions of consuming large quantities of fish
- commercial anglers who have access to large quantities of fish from the contaminated source, and
- recreational fishers who have a strong preference for fish over meat or poultry.

The individual fisher receptor modeled in this risk assessment fits this definition. The fisher scenario, however, is not of concern because the risk due to the ingestion of fish cannot be

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<sup>156</sup>Ebert, E.S., P.S. Price, and R.E. Keenan. 1996. Estimating exposures to dioxin-like compounds for subsistence anglers in North America. *Organohalogen Compounds* 30:169-172.

estimated because there are no appropriate biotransfer factors for fish and risk to the fisher due to direct soil ingestion is not above a level of concern for any waste stream.

**Comment 3:** EPA suggests that individual risk estimates can be used to support a decision to list a waste stream as hazardous, even though not one person is believed to be exposed, if the theoretical individual risk is elevated. Population risks should be considered as an additional factor. (API, 00046)

**Response:** See population risk discussion in Section IV.B of the NODA response to comment document for crude oil storage tank sediment. The location of receptors is addressed in the uncertainty and variability analysis performed in as a part of the risk assessment for the final rule. Population risk is also included in this analysis, although the listing decision is based primarily upon significant individual risk estimates and other factors.

**Comment 4:** Six different refineries reported using four different refinery wastes as onsite road material in 1992, yet EPA did not assess the risks posed by this form of use constituting disposal.<sup>157</sup> In the case of CSO sludge, EPA assigned 314 MT as the high-end volume value for this practice in 1992, and that volume may increase substantially absent a hazardous waste listing restricting land placement of this waste.<sup>158</sup>

EPA claims modeling land treatment sufficiently accounts for the risks posed by use constituting disposal.<sup>159</sup> This claim would have greater merit had EPA not arbitrarily assumed land treatment units are equipped with run-off controls operating at 50% efficiency. The effect of this assumption is to trivialize the potential non-groundwater risks posed by land treatment.

Since the evidence presented by EPA in support of the land treatment unit 50% run-off control efficiency assumption does not apply to onsite roads or other onsite uses constituting disposal, either EPA must evaluate the risks posed by the latter management practice or utilize risk analyses that assume no run-off controls for the various wastes. For CSO sludge, those cancer risk estimates are  $2 \times 10^{-3}$  for subsistence farmers and home gardeners, which strongly suggests the risks posed by use constituting disposal would be high.<sup>160</sup> Similar evaluations should be conducted for those wastes that are or could be managed in this manner, such as the other tank sludges covered in this rulemaking. (EDF, 00036)

**Response:** Only two refineries managed CSO sediment as road bed in 1992: one managing 97

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<sup>157</sup>One refinery also reported using FCC fines as "onsite fill material".

<sup>158</sup>1995 Listing Background Document at 44.

<sup>159</sup>1995 Listing Background Document at 45.

<sup>160</sup>1995 EPA Non-Groundwater Risk Assessment, Appendix K at 10-11.

metric tons and the other managing 314 metric tons.<sup>161</sup> These data demonstrate that this is a fairly rare management practice. In addition, and as discussed in Section III.G of this document, the commenter's characterization of the Agency's assumptions regarding the use of run-off controls is inaccurate for the high end analysis. No such controls were assumed for the high end analysis, upon which the listing determination was based. EPA believes that the modeled land treatment conditions are conservative surrogates for road spreading for reasons discussed in Section IV.C of the NODA response to comment document.

Regardless of whether or not this scenario was modeled, this residual is being listed as a hazardous waste. Note that the Agency addresses this comment in more detail in the NODA Response to Comments Document, Section IV.C, Comment 1.

**Comment 5:** CSO residuals warrant hazardous waste listing irrespective of management practice. EPA's risk assessment methodology substantially underestimated the risks associated with all the relevant forms of disposal because the Agency. The specific areas identified by the commenter as deficiencies are described further in Comments 6 through 14. (EDF, 00036)

**Response:** EPA disagrees with the commenter's assertion that the Agency's risk assessment is substantially deficient and grossly understates the risks from clarified slurry oil sludge. The commenter's specific concerns regarding EPA's risk assessment for this waste stream and the Agency's responses are provided below in Comments 6 through 14.

**Comment 6:** EPA failed to model the use of this waste as landfill cover or road materials. (EDF, 00036)

**Response:** As discussed immediately above in response to Comment 4, the Agency asserts it is unnecessary to evaluate the pathway of "onsite road material" because of the adequacy of the land treatment modeling. This residual was not reported to be used as landfill cover and thus was not evaluated with respect to this scenario.

**Comment 7:** EPA used TCLP results as the input values to the landfill groundwater modeling despite the acknowledged ineffectiveness of the procedure for oily wastes. (EDF, 00036)

**Response:** As discussed in detail in Section III.H, EPA remains convinced that it is appropriate to use the TCLP to characterize these residuals and to use TCLP results as input to the groundwater model. The TCLP results for this residual appeared to be reasonable and consistent with the observed characteristics of the waste. Only one sample contained detected levels of total benzene at 1,200 ug/kg (see Table 2 of Supplemental Background Document, Listing Support Analyses, 1997 ). The TCLP results for this sample, 84 ug/L, indicated that all of the available benzene leached from the sample. The benzene content of this waste, however, was demonstrated to be so low (near the detection limit in one of four samples) that no risk was apparent in the

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<sup>161</sup>1992 RCRA §3007 Survey.

ground-water model. While this waste did have significant levels of PAHs, as demonstrated by the elevated indirect pathway risk levels, the TCLP detection limits were higher than the PAH solubilities and it was therefore impossible to assess the risk associated with these constituents.

CSO Constituents of Concern	Average Total Concentration (ug/kg)	TCLP Detection Limit (ug/L)	Solubility (ug/L) <sup>1</sup>
Benz(a)anthracene	202,969	100	12.8
Dibenz(a,h)anthracene	36,958	100	0.67
Benzo(a)pyrene	13,200	100	1.94
Benzo(b/k)fluoranthene	76,750 (b/k)	100	4.3 (b)
Benzo(k)fluoranthene		100	0.94
3-Methyl cholanthrene	23,813	100	0.19
7,12-Dibenz(a)anthracene	330,938	100	50

<sup>1</sup>Source: "Supplemental Background Document; Listing Support Analyses", CSO Headworks Analysis, March, 1997.

**Comment 8:** EPA failed to account for the effects of co-disposal with other refinery and industrial wastes in its modeling. (EDF, 00036)

**Response:** EPA did include this waste in its analysis of co-disposal undertaken in the NODA, in order to evaluate the potential impact of regulating this waste under a conditional listing, resulting in continuing landfilling. As described in the NODA, such an analysis did not provide any further basis for listing. However, EPA has decided to unconditionally list this waste, so any potential for increased risk from a nonhazardous landfill due to co-disposal is no longer possible.

**Comment 9:** EPA failed to account for the free-phase flow of contaminants. (EDF, 00036)

**Response:** Section III.K of this document discusses the potential for free-phase flow and the Agency's conclusion that free-phase flow is unlikely with these residuals. It is particularly important to note that none of the four CSO sludge samples exhibited multi-phase behavior.

**Comment 10:** EPA improperly assumed land treatment units managing this waste would always be equipped with run-off controls operating at 50% efficiency. (EDF, 00036)

**Response:** This is discussed in Section III.G of this document.

**Comment 11:** EPA inappropriately assumed a small waste unit area size for offsite landfills in its



evaluation of dissolved phase contaminant flow, and improperly assumed a short active life for all landfills. (EDF, 00036)

**Response:** As covered in greater detail in Sections III.J and III.L of this document, the groundwater risk assessment modeling has been adjusted to improve its consideration of off-site landfill area and landfill active life assumptions.

**Comment 12:** EPA failed to consider risks to subsistence farmers and fishers. (EDF, 00036)

**Response:** Subsistence fishers and farmers were not addressed definitively in the proposed rule because of the substantial uncertainties associated with the biotransfer factors for PAHs. EPA has since attempted to address uncertainties associated with bioaccumulation of PAHs in fish and mammals. A detailed discussion of this effort are provided in Section III.M of this document and the Uncertainty Analysis: NonGroundwater Pathway Risk Assessment, 1998.

**Comment 13:** EPA failed to consider risks from dermal and inhalation exposure to groundwater contaminants such as benzene. (EDF, 00036)

**Response:** EPA responds to this document in general in Section III.O.

**Comment 14:** EPA failed to sum risks across groundwater and non-groundwater pathways. (EDF, 00036)

**Response:** See Section III.R of this document.

**Comment 15:** When all the flaws in the risk assessment methodology are addressed, and EPA truly characterizes the risks posed by the CSO residuals, the risk levels would vastly exceed presumptive listing levels. (EDF, 00036)

**Response:** As described in detail in Section III of this document, EPA has modified a number of elements of the risk assessment methodology in response to comments submitted by this and other commenters. In addition an uncertainty analysis has been conducted for the risk assessment for this rule. The results of the re-analysis show that the ground-water risk increased slightly from greater than  $1 \times 10^{-6}$  to  $4 \times 10^{-6}$  and the non-groundwater risk changed slightly from the proposed rule to the NODA as described in Table IV.B-1. An uncertainty/variability analysis has been performed in support of this risk assessment and the detailed description of this analysis is presented in the Uncertainty Analysis: NonGroundwater Pathway Risk Assessment, 1998.

**Table IV.B-1 NonGroundwater Risks From CSO Sediment**

	Home Gardener	Adult Resident	Subsistence Farmer	Subsistence Fisher
On-site land treatment				

Proposal	$6 \times 10^{-5}$	$9 \times 10^{-5}$		
April 8, 1997 NODA	$1 \times 10^{-4}$	$2 \times 10^{-5}$	$2 \times 10^{-4}$	$4 \times 10^{-5}$
Off-site land treatment				
Proposal	$5 \times 10^{-5}$	$8 \times 10^{-5}$		
April 8, 1997 NODA	$3 \times 10^{-5}$	$1 \times 10^{-5}$	$2 \times 10^{-5}$	$3 \times 10^{-5}$

Based on the substantial risks arising from PAHs in land treatment of this waste, EPA has determined to list this waste as hazardous. Substantial risks to residents and home gardeners near on-site and off-site land treatment units may occur through ingestion of contaminated soil released from these units. The contaminants of concern, PAHs, also tend to accumulate in food sources such that this waste causes even higher risks to nearby subsistence farmers and fishers. EPA is not promulgating any of the proposed options for conditional listing, because revised risk analysis for releases from off-site landfills showed some risks of concern to consumers of groundwater.

**Comment 16:** The average total concentration of chrysene in the CSO residuals substantially exceeds the comparable concentrations in F037, F038, K143, K144, and K145 that caused those wastes to be listed in 1990 and 1992. The average total concentration of benzo(a)pyrene in the CSO residuals substantially exceeds the comparable concentrations in F038, K143, K144, and K145 that caused those wastes to be listed in 1990 and 1992. In addition, concentrations of benz(a)anthracene and benzo(a)fluoranthene (total) in the CSO residuals exceed comparable concentrations in K143, K144, and K145 that caused those wastes to be listed in 1992. And the concentration of indeno(1,2,3-cd)pyrene in the CSO residuals exceeds the comparable concentration in K145 which caused that waste to be listed in 1992. (EDF, 00036)

**Response:** EPA recognizes that this and other residuals characterized in this listing determination contain concentrations of toxicants equal to or greater than previously listed wastes, including the F037 and F038 refinery residuals. Direct comparison of these concentrations to previous listing benchmarks is not an adequate basis for listing given the significant advances in the Agency's risk assessment expertise. See also EPA's response to Comment 14 in Section IV.A.5, above.

**Comment 17:** The waste constituent characterization is uncertain and likely leads to overestimating risk. Many of the detected concentrations are given as qualified results by the reporting laboratory. For several constituents, the single detected concentration was flagged with a "J." Thus, where this concentration leads to an unacceptable risk estimate, a refinery residual for the entire industry potentially could be listed based on a single estimated concentration in one sample. (API, 00046)

**Response:** EPA disagrees that the waste constituent characterization is uncertain and that the determination hinged on a single estimated value. The analytical protocols developed by EPA as outlined in the Quality Assurance Project Plan (QAPjP) dated September 22, 1993, which the

commenter reviewed for adequacy during the development (as noted in API letters from Roger Claff dated October 9, 1992, and November 24, 1992), for the analysis of the petroleum refining residuals resulted in the reporting of constituents that EPA had a high degree of confidence in their presence in the sampled materials. This confidence is founded in the extensive QAPjP-specific quality assurance protocols followed during analysis, the data validation of the laboratory reports conducted by EPA and its contractor, as well as (incidentally) the good agreement between EPA's results and the split samples analyzed by API as noted in the joint EPA/API report titled "Comparison of EPA and API Laboratory Results as Part of the 1992-1996 Petroleum Refinery Listing Study," presented at the Twelfth Annual Waste Testing and Quality Assurance Symposium on July 25, 1996. The analytical protocols included the establishment of Quantitation Limits (QL) as defined in SW-846, Method 8000B, as the minimum level of detection corresponding to the lowest calibration concentration while taking into consideration the waste matrix, and any required sample preparation and analysis dilutions. The contract laboratory was able to accurately detect and quantify constituents below these quantitation limits, but above the method detection limits (MDLs) as defined in SW-846, Chapter One, as the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero. Sample concentrations in this range (i.e., between the QL and MDL) were calculated in the same manner as those values reported above the QL using the confirmed responses of each target analyte compared to a daily calibration curve generated using certified standards of all target analytes. The "J" flag assigned to the value simply indicated that the measured concentration was below the QL and above the MDL, and therefore of increasing uncertainty as the measurement approaches the method detection limit. The "J" flag is not an indication that the detected constituent may not in fact be in the waste, but rather is an indication that the quantitation of that constituent's concentration is less reliable than if it had been detected above the QL. EPA used the values calculated by the laboratory using the calibrated response curve for extrapolation below the QL as the best estimate of the concentrations available.

Two options exist for the evaluation of "J"-flagged constituents. The first option is to use the values calculated by the laboratory using the calibrated response curve for extrapolation below the QL. The second option is to simply assume that the concentration is one-half the QL. The Agency believes that it is much more appropriate to use the "J" values than the crude estimate of one-half the QL. The one-half QL assumption could bias the results high for trace values and underestimate results of comparable reproducibility near the quantitation limit.

With respect to the impact of the "J" values on the listing determination, EPA did weigh the factor of analytical uncertainty in its decision making. The "J" values were determined to be valid characterizations of the waste composition, and the preponderance of PAHs in the waste supported this characterization. In other words, these constituents were not anomalous but were expected to be present in the wastes as a result of their point of generation in the FCC process (i.e., sediments settling from the bottom fraction of petroleum hydrocarbons). The CSO sediment listing determination did not hinge on a single estimated value, but, as discussed in the final rule, considered all of the constituents that showed risk and other potential risk factors.

**Comment 18:** A single concentration was reported for the total concentration of both benzo(b)fluoranthene and benzo(k)fluoranthene. EPA used this reported concentration to represent the concentrations of benzo(b)fluoranthene and benzo(k)fluoranthene individually, resulting in an overstatement of the risk posed by these two chemicals. (API, 00046)

**Response:** The commenter is wrong in its characterization of how EPA utilized this measurement. A single concentration was reported for the total concentration of benzo(b)fluoranthene and benzo(k)fluoranthene. This reported concentration was assumed to be equal to the maximum concentrations of both benzo(b)fluoranthene and benzo(k)fluoranthene that might exist in the environment. However, while the maximum potential risk for each isomer was calculated and included in the risk table, only the isomer showing the highest risk was summed in the estimate of the total waste stream risk. Thus, no double counting of risk from these isomers occurred.

**Comment 19 :** Even using EPA's flawed exposure methodology, the results of EPA's risk analysis state "incremental risk in terms of cancer cases avoided would be near zero," and therefore, there are virtually no environmental benefits to listing CSO storage tank sludge. (NPRA, 00015)

**Response:** EPA's response to comments regarding population risks can be found in Section IV.B of the NODA Response to Comments Document.

**Comment 20 :** EPA started the listing by stating that "the high-end risks to individuals for these wastes support listing them as hazardous." However, EPA provides no justification for this statement and in fact does not follow its own guidance referenced in this rulemaking as being in the preamble to the dye and pigment listing. (NPRA, 00015; Phillips, 00055)

**Response:** EPA's original and revised risk assessments support the listing determination for CSO sediment. The Agency disagrees with the commenters' claim that the decision is inconsistent with the guidance given in the dye and pigment preamble, since the risks associated with this residual are above the  $1 \times 10^{-5}$  presumptive listing benchmark. The guidance the commenter cited is the December 22, 1994 proposed rule for the dye and pigment listings, in which EPA discussed the use of risk levels in making listing decisions (59 FR 66075-66077).

3. Risk Assessment Issues: Land Treatment [see also Section III of this response to comment document.]

**Comment 1:** Without an assumption of unrestricted overland flow, most of the estimated risks would not occur; consequently, this decision lies at the heart of the proposed listing for CSO sediments. Because this assumption contradicts EPA's data on industry use of run-on/run-off controls, it should not be used to support a decision to list CSO sediments. (API, 00046)

**Response:** As discussed earlier in Section III.G and in response to Comment 3 of Section IV.A.6

regarding crude oil tank sediment, EPA cannot assume complete control of run-on and run-off at land treatment units and still characterize the management scenario as reasonable mismanagement.

**Comment 2:** EPA based its decision to list CSO storage tank sludge on risks to the home gardener and the adult resident from erosion/runoff of soils from land treatment units. EPA's soil transport premise is flawed and therefore there is no exposure pathway and resulting risk from these soils. (NPRA, 00015; Valero, 000051)

**Response:** See Section III.F for a full discussion of the Agency's response to the commenters' detailed concerns with its modeling of soil transport. After considering these comments and making revisions to the transport model as described in the April 8, 1997 NODA, the Agency's revised risk assessment for the home gardener and adult resident show risks of  $2 \times 10^{-4}$  and  $4 \times 10^{-5}$ , respectively, for on-site land treatment, and  $2 \times 10^{-5}$  and  $3 \times 10^{-5}$ , respectively, for off-site land treatment (see Table III in the April 8, 1997 NODA).

**Comment 3:** EPA's discussion of the run-on/run-off control says that controls would need to be 90 percent effective to reduce high end risks to below  $10^{-6}$ . The implicit target risk of  $10^{-6}$  is inconsistent with EPA published guidelines on hazardous waste listing. For CSO sediments, it appears that EPA has not yet followed its own guidance in applying listing factors. A description as to how each of the listing factors weighs for or against listing should be provided in the preamble to the final rule. (API, 00046; Phillips, 00055; Valero, 00051)

**Response:** The commenter raises two issues: the use of  $10^{-6}$  as an implicit risk target, and the application of the listing factors (See also response to comment 20 in Section IV.B.2 ).

In the December 22, 1994 proposed rule for the dye and pigment listings, EPA presented its hazardous waste listing determination policy. As part of this policy, EPA discussed the use of risk levels in making listing decisions (59 FR 66075-66077), and discussed various thresholds that are used as guidelines in those decisions. With respect to a risk level of  $10^{-6}$ , EPA said,

“Wastestreams for which these risks are calculated to be  $1 \times 10^{-6}$  or lower, and lower than 1.0 HQs or EQs for any non-carcinogens, generally will be considered not to pose a substantial present or potential hazard to human health and the environment and generally will not be listed as hazardous waste. Such wastestreams fall into a category presumptively assumed not to pose sufficient risk as to require their listing as hazardous waste. However, even for these wastestreams, in some cases, there can be factors that could mitigate the low hazard presumption. These also will be considered by the Agency in making a final determination.”

EPA's statement regarding the efficacy of the run-on/run-off controls simply is stating that those controls would need to avert 90 percent of the run-on/run-off to ensure risk results triggering the low hazard presumption. This is not the establishment of a new “implicit target risk”, and is not inconsistent with the policy described in the 12/20/94 Federal Register notice.

With respect to the commenters' second issue, the Agency has dealt with the applicability of the listing factors to the CSO sediment listing determination throughout the risk assessment process. Specifically, EPA has extensively considered the role of the characteristics in determining risk and the need for listing (261.11(a)(1)). The risk assessment itself is based on an extensive evaluation of the toxic constituents found in the residual (261.11(a)(3)), including the nature of the toxicity (261.11(a)(3)(I)) and the concentration (261.11(a)(3)(ii)) of the constituents. In addition, the risk assessment considered the potential for migration from a variety of management practices (261.11(a)(3)(iii)), the persistence of the constituents (261.11(a)(3)(iv)), the potential for degradation (261.11(a)(3)(v)) and bioaccumulation (261.11(a)(3)(vi)) of the toxicants of concern. The listing determination also relies on an extensive evaluation of the plausible types of improper management to which the waste could be subjected (261.11(a)(3)(vii)) and the quantities of waste generated (261.11(a)(3)(viii)).

**Comment 4:** EPA apparently has not documented any damage cases where the land treatment of CSO sediments led to the migration of PAH contaminated soils to nearby residences. Thus, there appears to be no actual evidence that management of CSO sediments in land treatment units leads to exposure of nearby residences, and no reason to believe that it would in the future. While EPA's risk estimate greatly overstates potential risks from CSO sediment that is land treated, such projections become even less relevant when empirical evidence of harm to human health or the environment is scarce or nonexistent. (API, 00046)

**Response:** EPA attempted to identify damage cases wherever possible to support its listing determinations. (EPA. Assessment of Risks from the Management of Petroleum Refining Wastes: Background Document. October 1995.) However, consideration of damage cases is only one of the factors to consider for listing. EPA, as noted in the previous comment, shows how it weighed all the different factors to decide to list CSO. Moreover, at the outset of this investigation, EPA assumed that the contamination at refineries would tend to be difficult to characterize in terms of specific sources due to the multiple potential sources (e.g., product spills, crude spills, waste management of materials with similar compositions, multiple management units) with very similar contaminants (ibid). Thus while it is common at a refinery with environmental contamination to find measurable levels of benzene, PAHs, or metals, it is very difficult to definitively determine whether the contamination is due to product or raw material spills, management units, or releases of the specific residuals considered in this listing determination.

Similarly, while EPA has identified damage cases resulting from releases at petroleum refineries, it would be virtually impossible to tie the release solely to CSO sediments in land treatment units due to (1) the management of multiple residuals in land treatment units, (2) the infrequent generation of CSO sediments, and (3) the lack of a marker contaminant unique to CSO sediments that could be linked to documented releases. Thus the lack of empirical evidence is not surprising, but does not prove that releases are not possible or even unlikely. For this reason, EPA did not attempt to rely heavily on damage cases that directly linked releases to the specific residuals of concern. Instead EPA's weight of evidence considerations emphasized its data

collection efforts (i.e., the 1992 survey and field study), which have been widely praised by the commenters (see Section I.B), and that provided EPA with the raw material to evaluate a wide variety of measures of risk (e.g., indirect modeling of numerous pathways, groundwater modeling, hazardous waste characteristics). By using information beyond proven damage cases, EPA hopes to *prevent* releases that lead to environmental damage.

#### 4. Risk Assessment Issues: Home Gardener

**Comment 1:** EPA's estimate of risks from CSO sediment due to the consumption of homegrown vegetables contains many mathematical errors, unsupported findings, and unjustified parameter values, which result in substantial overestimation of risks from this exposure route. (API, 00046)

**Response:** The home grown vegetable ingestion pathway has been reexamined. A revised deterministic risk assessment is described in the Supplemental Background Document for the NonGroundwater Pathway Risk Assessment (1997). In addition, and uncertainty/variability analysis has been performed which is described in detail in the Uncertainty Analysis: NonGroundwater Pathway Risk Assessment (1998). These documents describe in detail the sources of risk in the ingestion of home grown vegetables pathway for the home gardener and the farmer. Comments on the additional analyses are discussed in the NODA Response to Comments Document.

#### 5. Biodegradation

**Comment 1:** EPA has failed to consider the biodegradation of PAHs in land treatment units and at off-site receptor locations, overstating risks from PAHs in soils. (API, 00046; Phillips, 00055, Sun, 00034)

**Response:** EPA agrees that biodegradation may be a significant removal process for PAHs and should be considered in analysis of PAH fate and transport. See response to comment 1 of Section III.B of this document.

**Comment 2:** EPA did not consider degradation of PAHs in soils at the receptor site. EPA's rationale for not considering biodegradation was that degradation rates vary greatly depending upon site-specific conditions. While biodegradation can be affected by a variety of environmental factors (i.e., organic carbon content, soil particle size, microbial population, etc.), it is a significant loss mechanism for PAHs in soil. Because biodegradation can significantly affect long-term estimates of soil concentrations, the failure to consider this loss mechanism may result in substantial overstatements of risks resulting from soil exposures. (See Exxon comment for data) (API, 00046; Exxon, 00035)

**Response:** See response to comment 1 of Section III.B.

**Comment 3:** Lacking site-specific data, EPA should consider the published data on

biodegradation rates for a variety of soil conditions, and choose rates that most closely resemble the soil conditions modeled for the assessment. The soil condition corresponding to the typical and high-end locations could then be used in the analysis. Alternatively, a conservative approach would be to identify the highest half-life (or lowest biodegradation rate) for each individual PAH and apply the corresponding rate to the risk assessment. (API, 00046)

**Response:** See response to comment 1 of Section III.B. EPA undertook a full uncertainty analysis for the risks posed by PAHs, including consideration of the variability in biodegradation rates for the PAHs. As noted in the NODA response to comment document (Section I.B.2, Comment 14) , the Monte Carlo uncertainty analysis supported the listing decision based on the high-end analysis.

**Comment 4:** Since the weight of the evidence only marginally supports a listing decision, and EPA did not consider biodegradation, a listing of CSO sediment is not warranted. (Exxon, 00035)

**Response:** As discussed above and in response to comment 1 of Section III.B, EPA incorporated biodegradation of PAHs in its revised risk assessment in response to public comments.



## C. CATALYST FROM HYDROTREATING AND HYDROREFINING

### 1. Scope of Listing

**Comment 1:** The definitions currently proposed have significant potential to cause confusion regarding the applicability of the Agency's proposed rule... The definitions were extracted from the Oil & Gas Journal to provide general guidance for grouping of refining units, however, such definitions were never intended for regulatory classification purposes. The rapid advances and diversification of hydroprocessing, i.e., a general term used to include hydrotreating, hydrorefining and hydrocracking processes, made by the petroleum refining industry have rendered such definitions obsolete. This is not a concern for the intended use of the definitions; however, when regulatory classifications are involved, such limitations become significant.

In Section III.G.3.b. of the proposed rule, the Agency uses the term "hydroprocessing" as a general operational category to include hydrotreating, hydrorefining and hydrocracking processes. We tend to agree in the absence of sound technical definitions, and based upon contacts within the refining industry we believe it offers the correct framework to develop a more concise definition. We propose, as a starting point, the following outline.

Hydroprocessing - Term encompassing different refining processes that always has one thing in common - oil, hydrogen and catalyst being used together. Hydrogen is added to all of these processes.

- Hydrotreating - Primary purpose is heteroatom (S, N, and O) removal. Metal contaminant removal (As, Fe, Ni, V, etc.) may also occur. Some other chemical changes may also take place, such as olefin and/or aromatic saturation.
- Hydrorefining - Primary purpose is upgrading heavy fractions (typically boiling above 650°F and having significant amounts boiling above 1000°F). This is typically achieved by a reduction of Conradson Carbon, heteroatom removal, and substantial metal contaminant removal (As, Fe, Ni, V, etc.). Conversion, typically from residue to VGO and lighter boiling materials, is achieved by a combination of thermal and hydroprocessing reactions.
- Hydrocracking - Conversion of a feedstock that has already been separately hydrotreated prior to Hydrocracking to remove heteroatoms and metals.

The Hydrocracking process uses an acidic site catalyst such as zeolite or amorphous silica alumina for primary catalytic and not thermal conversion.

Hydrocracking is defined as >50% up to 100% conversion and is associated with significant catalytic molecular weight reduction typically from gas oils and heavy gas oils to light boiling ranges acceptable for use as motor fuels (e.g., diesel and jet type fuels) or

naphtha suitable for octane reforming to gasolines. Conversion is defined as a reduction of the amount of material boiling above a certain temperature.

Given these “process definitions” and the rationale for classification of spent catalysts, we suggest the agency adopt comprehensive descriptions within the rule. The following “comprehensive definitions” illustrate the potential problems resulting from “oversimplified” definitions.

Hydrotreating and Hydrorefining - The catalysts covered by this rule are those consisting of combinations of two or more of the metals nickel, cobalt, molybdenum and tungsten with or without additional promoters such as phosphorous, boron, silica, titanium, fluoride, etc. and supported on porous carriers comprising of alumina, silica alumina, silica, “zeolite” and combinations thereof and having been used in the refining or petrochemical industry for hydrogenation, hydrotreating, and/or hydrorefining applications. For purposes of this rule, hydroprocessing, hydrotreating and hydrorefining applications will include naphtha hydrotreating, naphtha desulfurization and denitrification, gas oil desulfurization and denitrification, cat cracker feed hydrotreating, vacuum gas oil desulfurization, denitrification and demetallization, distillate cold flow improvement, pretreatment of hydrocracker feeds, denitrification of hydrocracker feeds, “so called” first stage hydrocracking, “so called” mild hydrocracking, silica guard, sulfur guard, ebullating bed residue upgrading, residue demetallization, residue conversion, lube oil finishing, lube oil polishing, white oil production, aromatic saturation, olefin saturation, reformer pretreatment, isomerization pretreatment, and tail/gas pretreatment, if a catalyst meeting the compositional definition above is used in said processes.

Hydrocracking - The catalysts covered by (a hydrocracker) rule are those consisting of two or more of the metals nickel, cobalt, molybdenum and tungsten with or without additional promoters such as phosphorus, boron, fluoride, etc. and supported on porous carriers composed of amorphous silica alumina, crystalline zeolite, alumina silica and combinations thereof, and having been used in the refining and petrochemical industry for a hydrocracking application. For purposes of this rule, hydrocracking will be defined as a process in which a refinery stream or streams are cracked in the presence of hydrogen to achieve greater than 50% molecular weight reduction over a catalyst described herein and where said feedstock has been previously hydrotreated in a separate hydrotreating step to achieve high levels (greater than 90%) of heteroatom (N, S, and O) removal and metals removal before passing over the hydrocracking catalyst.

In our judgment, failure to adopt improved definitions for hydrotreating, hydrorefining and hydrocracking processes will unduly burden the regulated community and set the stage for future litigation and liability. (CRI-MET, CRI, 00030, CRITERION, 00040)

**Response:** In the proposed rule EPA also noted that the terms hydrotreating and hydrorefining are somewhat loosely used within the industry. Several commenters requested a more concise definition of the terms to clarify the definitions of hydrotreating, hydrorefining and hydrocracking

processes.

EPA examined three types of hydroprocessing catalysts identified in the EDF consent decree: hydrotreating catalyst (listing candidate), hydrorefining catalyst (listing candidate), and hydrocracking catalyst (study residual). Spent hydrotreating and hydrorefining catalysts have been proposed for listing and will be promulgated as hazardous wastes in today's rule; no action has been proposed to date for spent hydrocracking catalyst. Public comment was submitted regarding EPA's hydroprocessing catalyst definitions.

All three processes are part of a continuum of catalytic hydroprocessing units. Definitions for the three categories of hydroprocessors are not universally established or accepted. Generally, the three processes may be viewed in the following order of increasing degrees of severity of operating conditions and conversion of larger hydrocarbons to smaller molecules ("cracking"), and/or feeds: hydrotreating, hydrorefining and hydrocracking. The types of catalysts used can be similar in all three processes.

The proposed regulatory language did not attempt to define these catalysts, or differentiate them from hydrocracking catalysts. The proposal referred to definitions used in the *Oil and Gas Journal* (60 FR 57767, fn. 7), which indicates that hydrotreating includes processes where essentially no reduction in the molecular size of the feed occurs, that hydrorefining includes processes where 10 percent of the feed or less is reduced in molecular size, and that hydrocracking includes processes where 50 percent of the feed or more is reduced in molecular size.

Commenters on the proposal noted that the preamble definitions did not provide a complete continuum, resulting in an unclear area between hydrorefining and hydrocracking. Specifically, since hydrorefining covered conversion rates up to 10 percent and hydrocracking covered conversion rates greater than 50 percent, as defined by the *Oil and Gas Journal*, it was not apparent how EPA would classify processes with conversion rates between 10 and 50 percent. Several solutions were suggested by the commenters:

- One refiner suggested that EPA establish a definition of hydrocracking that assumes a conversion rate of 15 percent or greater and the use of downstream fractionation.
- A catalyst reclaimer suggested extensive regulatory language describing the specific types of catalysts, catalysts support media, and catalytic applications associated with the different hydroprocessing categories.
- Other refiners commented that EPA should clarify that any process with conversion rates greater than 10 percent should be classified as hydrocracking.

Each of the options is problematic. Reliance on specific conversion rates may allow for slight changes in operating and accounting practices to result in reclassification of units that would

otherwise be considered hydrorefiners. Similarly, use of fractionation could be interpreted to include stripper columns commonly employed after hydrotreating and hydrorefining. The catalyst reclaimer's suggested language was an exhaustive attempt to distinguish the types of processes EPA intends to be within the scope of the listings, however, other commenters argued it was inappropriate to adopt the reclaimer's suggestion because EPA did not have sufficient basis to expand the definition in this way. At this time, the Agency is reluctant to adopt this extensive list within the regulatory language without additional review and perhaps further information collection.

Upon reviewing all of the relevant materials available in the docket, the Agency believes that the simplest way to differentiate between hydrocracking units and other hydroprocessing units is to rely on the categorization used in the Department of Energy's *Petroleum Supply Annual*. Refineries are required to submit Form EIA-820 annually to DOE's Energy Information Administration. This form includes the mandatory submission of data on operating capacity for catalytic hydrocracking and catalytic hydrotreating. Catalytic hydrocracking is defined in the *Petroleum Supply Annual* as:

"A refining process that uses hydrogen and catalysts with relatively low temperature and high pressures for converting middle boiling or residual material to high-octane gasoline, reformer charge stock, jet fuel, and/or high grade fuel oil. The process uses one or more catalysts, depending upon product output, and can handle high sulfur feedstocks without prior desulfurization."

Additionally, catalytic hydrotreating is defined in the *Petroleum Supply Annual* as:

"A refining process for treating petroleum fractions from atmospheric or vacuum distillation units (e.g., naphthas, middle distillates, reformer feeds, residual fuel oil, and heavy gas oil) and other petroleum (e.g., cat cracked naphtha, coker naphtha, gas oil, etc.) [i]n the presence of catalysts and substantial quantities of hydrogen. Hydrotreating includes desulfurization, removal of substances (e.g., nitrogen compounds) that deactivate catalysts, conversion of olefins to paraffins to reduce gum formation in gasoline, and other processes to upgrade the quality of the fractions."

For the purposes of the K171 and K172 listing descriptions, catalytic hydrorefining is defined as a refining process with more severe (higher temperature and pressure) operating conditions than the catalytic hydrotreating process defined above for treating the heavier molecular weight petroleum fractions, residual fuel oil and heavy gas oil.

Based on the *Petroleum Supply Annual* definitions stated above, if a refinery has been classifying its hydroprocessor as a catalytic hydrocracker for the purposes of the DOE's Form EIA-820, spent catalyst from this unit would not be covered by K171 or K172 (with the exception of guard beds, as discussed further below). Conversely, if a refinery has been classifying its hydroprocessor as a hydrotreater processing feeds other than residual fuel oil or heavy gas oil,

spent catalyst from this unit would be classified as K171; spent catalyst from a similar unit processing residual fuel oil or heavy gas oil would be classified as K172. Refineries have been reporting capacity information to DOE for many years and today's rulemaking should serve as a reference for the classification of these units.

In addition to the issue of defining hydrocracking units that are not subject to the K171/K172 listing, there is disagreement among commenters from the petroleum industry and catalyst reclaimers regarding the classification of guard beds. These units, also known as desulfurization pretreaters, are used to extend the life of the downstream catalytic bed (reformer, hydrocracker, isomerization reactor) by removing sulfur, oxygen, nitrogen, and/or heavy metals. Reclaimers argued to include such pretreatment of hydrocracker feeds, sulfur guards, reformer pretreatment, and isomerization pretreatment as part of the definition of hydrorefining or hydrotreating. The petroleum refining industry disagreed, stating that these pretreatment processes use more severe conditions (much higher pressure, high ratio of hydrogen to hydrocarbon) to achieve contaminant removal, and also provide a significant reduction in feedstock molecular size, often greater than the 10% cutoff in the EPA/*Oil and Gas Journal* hydrorefining definition. Thus, industry contends such catalysts more appropriately belong in the hydrocracking category.

EPA agrees that these pretreatment units, or "guard units", should be covered under the listing descriptions in today's rule. In reviewing the §3007 survey responses, EPA found that some refineries reported the catalysts from their guard beds under the category of the downstream unit. For example, nickel/molybdenum catalyst from a reformer pretreatment unit was sometimes reported as spent reforming catalyst, however, true reforming catalysts are based on precious metals such as platinum and palladium. EPA believes that these units were not reported as hydrotreaters because they often reside within the unit boundaries of the downstream units, are closely integrated with the downstream units, and such reporting simplified the refinery's response to the extensive §3007 survey. However, because this type of guard bed does not result in catalytic reforming (and similarly isomerization), these units were re-coded as hydrotreaters in the Agency's database. EPA has modified the regulatory language to clarify that the spent catalyst from all such pretreatment units should be classified as K171 or K172.

**Comment 2:** A serious problem in the proposed rule was differentiating between hydrorefining and hydrocracking catalysts. If a catalyst is in a service in which between 10 and 50 percent of the feed is reduced in molecular size, there is no obvious method to determine whether to consider it hydrocracking or hydrorefining. This type of service is common. The commenters support the following definitions for this rule:

Hydrotreating: no change in molecular size of the feed

Hydrorefining: up to 10 percent of the feed is reduced in molecular size

Hydrocracking: greater than 10 percent of the feed is reduced in molecular size

These definitions are logical because the objectives of both hydrotreating and hydrorefining are primarily sulfur and nitrogen removal in order to protect downstream catalysts. The primary goal of hydrocracking is, as the name implies, to 'crack' the feed into smaller, more useful molecules.

...From Mobil's perspective, EPA's use of the *Oil and Gas Journal* definitions of hydrotreating and hydrorefining is correct and most closely approximates refiners' understanding of what constitutes hydrotreating or hydrorefining. When coupled with the clear statement in the preamble (61 FR 57766, col. 3) that these listing determinations do not address hydrocracking operations, there should be little confusion. (API, ARCO, PHIBRO, MOBIL)

**Response:** See response to Comment 1 in this section.

**Comment 3:** CRI-MET's February 16, 1996 letter to Mr. Rick Brandes recommends an expansion of the definition for hydrorefining to include many additional processes not comprehended in the EPA 3007 Survey, the record sampling program, or the final October 31, 1995 Background Document. Clearly such an expansion would be to CRI-MET's benefit by creating additional potential customers if EPA finally determines to list these residuals. However, the commenters question if EPA has sufficient basis to expand the definition as CRI-MET requests.

...In essence, CRI-MET is advocating that the Agency leave the definition of hydrocracking unchanged, but expand the definition of hydrorefining to fill this gap. However, if the Agency follows CRI-MET's recommendation, it will in essence be regulating many processes that refiners consider to be hydrocracking operations. Moreover, EPA has clearly not established a basis for doing so. In the preamble and in the Background Document, EPA has clearly based these definitions on the established industry definitions in the *Oil and Gas Journal*. In addition, the record sampling for the hydrorefining category is consistent with the *Oil and Gas Journal* definition. The Background Document details three record samples for hydrorefining. The feedstock in two cases is diesel fuel, clearly a situation where the reduction of contaminants (sulfur) is the key objective and little reduction in molecular weight is expected or sought. The third sample involved a heavy gas oil feedstock which is being hydrorefined primarily to remove sulfur from feedstock to an FCC unit so that the FCC gasoline produced will have acceptable sulfur levels for blending into final finished gasoline product. Again, the Agency has examined a sample from a process where only a marginal reduction in feedstock molecular size is anticipated.

If EPA expands the definition of hydrorefining as CRI-MET recommends, it will begin to draw in processes where much more than a marginal reduction in feedstock molecular size is sought. Indeed, CRI-MET even lists "'so called' mild hydrocracking" in its recommended definition of hydrorefining. In addition CRI-MET lists "pretreatment of hydrocracker feeds, denitrification of hydrocracker feeds, 'so called' first stage hydrocracking" in its recommended definition, processes which, because of their severity (much higher pressure) and the high ratio of hydrogen to hydrocarbon required to achieve contaminant removal, also anticipate and provide a significant reduction in feedstock molecular size, often greater than the 10% cutoff in the EPA/*Oil and Gas*

*Journal* hydrotreating definition. The commenters contend and strongly recommend to EPA that such catalysts more appropriately belong in the hydrocracking catalyst category. The record better supports the commenters' recommendation that if any change in definition is made, it should be to change the definition of hydrocracking to include processes where 10 percent (rather than 50 percent) of the feed or more is reduced in molecular size. (API, Mobil)

**Response:** See response to Comment 1 in this section.

**Comment 4:** When the Agency does address spent hydrocracking catalysts more specifically, it may want to clarify the *Oil and Gas Journal* definition for hydrocracking to include processes where 10 percent (rather than 50 percent) of the feed or more is reduced in molecular size. Otherwise, there will exist a gap between the definition of hydrotreating (10 percent or less of the feed reduced in molecular size) and hydrocracking (50 percent or more of the feed reduced in molecular size). If not changed, this could lead to some confusion regarding the regulatory status of spent catalyst from hydrocracking operations that fall into this gap. For clarity, the Agency may wish to make this definition change now, but could defer it until it is necessitated by a future regulatory action involving spent hydrocracking catalysts. (API, Mobil)

**Response:** See response to Comment 1 in this section.

**Comment 5:** The K171 and K172 listing descriptions should explicitly exclude spent catalysts from hydrocracking operations. If the exclusion is not explicit in the listing description, the tendency for the listing to expand over time will be experienced, as preamble discussions of the listing descriptions are forgotten or never read. (Heritage, 00010)

**Response:** See response to Comment 1 in this section.

**Comment 6:** The commenter believes it is necessary for the EPA to clarify that tail gas catalyst, a type of hydroprocessing catalyst, is not included in the hydrotreating residual that is proposed for listing as K171. (Sun, 00034)

**Response:** Tail gas catalyst, classified as SCOT<sup>TM</sup>-like catalyst, was studied separately from hydrotreating and hydrotreating catalyst. This catalyst is used to remove hydrogen sulfide from the off-gas of the Claus sulfur plant and thus is in a less severe service than the hydrotreating and hydrotreating catalysts. EPA conducted a separate risk assessment of this residual and proposed a no list determination in the November 20, 1995 rule and is not listing it in the final rule.

**Comment 7:** The commenter requests confirmation that scrubber solids generated from processing spent hydrotreating catalyst and spent hydrotreating catalysts to control SO<sub>2</sub> and other gaseous emissions will not be designated hazardous under the "Derived from" definition as a result of these proposed rules. (Dakota Catalyst Products, 00044)

**Response:** The commenter is incorrect. In general, wastes generated from the treatment of listed

hazardous wastes are considered hazardous wastes. 40 CFR 261.3(c)(2). This includes the recycling activities described by the catalyst reclaimers who submitted comments on this rule. Wastes generated in the manner described by the commenter (e.g., “derived from” air pollution control wastes) **would** continue to carry the hazardous waste code and be subject to land disposal restrictions.

## 2. Use of the TCLP and the TC

**Comment 1:** The hazardous constituents and characteristics found in spent hydrotreating and hydrorefining catalysts are sufficiently covered by existing EPA (especially the TC) and DOT rules. (Amoco, 00062; API, 00046; ARCO, 00023; BP Oil, 00019; Chevron, 00050; Exxon, 00035; Mobil, 00033; NPRA, 00015; Texaco, 00049; Valero, 00051; Western Independent Refiners Association, 00024)

**Response:** The commenters argue that because the constituents of concern are part of the toxicity characteristic no regulation is necessary. Other commenters have argued that because wastes frequently exhibit the TC they should be listed.<sup>162</sup> The Agency’s decision has not been based on either position, but rather a weight of the evidence. The Agency notes that the results of the TC for volatile constituents are dependent upon storage conditions and the accumulation period prior to testing, such that the Agency’s random sampling immediately after generation showed significantly higher frequency of hazard than industry reports in the 3007 survey.<sup>163</sup> The Agency also notes that the wastes listed pose additional hazards due to self-heating properties, and that significant risks to human health or the environment would continue should these wastes not be regulated as Subtitle C hazardous wastes. Finally, EPA conducted an analysis in which the risk assessment inputs were capped at the TC levels. The results of this risk analysis, described further in the April 8, 1997 NODA, support EPA’s listing determination. Section I.A.4 of the NODA Response to Comments Document discusses these findings and resultant public comments further.

**Comment 2:** A refinery reviewed data from more than 30 spent hydrorefining and spent hydrotreating catalyst changeouts showing that approximately one third of spent catalyst reactor changeouts did not exceed the TC levels for benzene or arsenic or were classified as DOT self-heating. A nationwide listing would impose unnecessary RCRA burdens on these streams. The overregulation that would result from a spent catalyst listing provides EPA a significant incentive

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<sup>162</sup>See IV.E.2, Comment 2 in this response to comment document.

<sup>163</sup>Refiners reported approximately 27 percent of their hydrotreating catalyst exhibited the Toxicity Characteristic, while EPA’s field study showed 50 percent of its samples were TC hazardous for benzene. Industry reported 21 percent of their hydrorefining catalyst as exhibiting the Toxicity Characteristic for benzene or arsenic, while EPA’s field study showed all samples exhibited the characteristic for benzene or arsenic. (See the 1995 Listing Background Document for the 1992-1996 Petroleum Refining Listing Determination.)



to use methods such as toxicity testing and the DOT self-heating test to narrow the scope of regulation. (Exxon, 00035)

**Response:** This commenter's data is more in line with EPA's field study data, confirming EPA's assessment that these residuals frequently exhibit the Toxicity Characteristic. However, there are a number of other factors supporting EPA's listing determination for these materials, such as the risk assessment modeling results and the well-documented pyrophoric properties of these residuals. When a listing determination is so broadly supported, EPA is justified in identifying the waste of concern as a listed hazardous waste rather than relying on the intermittent coverage of the Toxicity Characteristic. EPA believes that the risk assessment clearly demonstrates that the TC will not provide adequate control of the risks presented by these wastes. As shown in the final revised groundwater analysis, even in the TC-capping results, both catalysts present risks in off-site landfills that exceed  $1\text{E-}5$  (see response to comment 4 below).<sup>164</sup> Specifically, for both hydrotreating and hydrorefining catalysts, the TC-capped arsenic risks exceed  $1\text{E-}5$  for the Monte Carlo and high-end evaluations, and the benzene risks exceed this benchmark in the high-end evaluation and approaches this level in the Monte Carlo analysis. Furthermore, both wastes exhibit self-heating properties that may not be adequately controlled by the existing ignitability/reactivity characteristic (see Listing Background Document for the 1992-1996 Petroleum Refining Listing Determination, 1995, pages 76-79).

**Comment 3:** EPA's arsenic TCLP data may have a positive bias and thus overstate the results. The commenter's review of the API data on arsenic in hydrotreating catalyst (R5-TC-01-S and R7B-RC-01-SS) showed a potential problem that may have also occurred in EPA's sample results. The total analyses were done by graphite furnace (EPA 7060) and the TCLP was performed by inductively coupled plasma (ICP) (EPA 6010). Clearly, there is a problem with the sample R7B-RC-01-SS where the extractable level is shown as much greater than the total. The problem with the TCLP data is a spectral interference in the ICP data. We strongly recommend that EPA check their data to verify they do not have a similar spectral interference causing a positive bias. (Chevron, 00050)

**Response:** Based on the API arsenic data for the hydrorefining catalyst, Chevron claims a spectral interference existed during the inductively coupled plasma (ICP) leachate analysis of sample R7B-RC-01-SS (BP Belle Chase) that created a positive (i.e., overstated) bias in the reported sample concentration. This claim was based solely on the non-detected (ND) total arsenic analysis performed by graphite furnace AA (GFAA) compared to the ICP TCLP leachate result (20.1 mg/L). Additional information such as API's laboratory quality assurance data to support the positive bias claim was not provided. Chevron further maintains the positive bias may also be present with the EPA arsenic TCLP data resulting in overstated leachate values being used as input to the risk assessment.

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<sup>164</sup>See Additional Groundwater Pathway Risk Analyses, Supplemental Background Document; Petroleum Refining Process Waste Listing Determination, 1998 in the docket.

In the absence of any API supporting ICP QC data, the Chevron claim of analytical spectral interference cannot be substantiated. As background to this comment, ICP spectral interferences are frequently encountered with high sample concentrations and trace level analysis near the method detection limits. Specifically, an arsenic spectral interference is suspected with samples containing high aluminum, chromium, and vanadium concentrations. However, these metals were not detected in the EPA leachate sample, and it is presumed the API analysis contained similar non-detects. Therefore, aluminum, chromium and vanadium are not likely to be possible spectral interferants. In addition, the presence of a spectral interference is considered unlikely given the reported sample concentration was approximately 100 times greater than the method detection limit. However, without API's laboratory QC data (including duplicate, matrix spike, and check standard results to evaluate precision and accuracy) the validity of the API results and the Chevron claim of an ICP spectral interference cannot be established.

Assuming the API leachate result is valid (20.1 mg/L) for sample R7B-RC-01-SS, the theoretical total concentration would be at least 400 mg/kg given 100 g were leached into 2 L. An initial data validation assessment should have questioned the validity of the non-detected total arsenic concentration. In addition, the data validation process should have resulted in several questions to the laboratory concerning the total arsenic detection limit, digestion procedures, analytical procedures, dilution factors employed, concentration reporting, and reanalysis confirmation. Even with a satisfactory laboratory response to these questions providing some assurance of data quality, many laboratories will routinely report questionable sample concentrations with a comment suggesting a possible matrix interference without confirming the validity of the data as reported. Furthermore, compared to the EPA total arsenic result (650 mg/kg), the API total result appears to be biased low and possibly erroneous. There are a number of possible reasons for the apparent laboratory error in the API total arsenic analysis including: digestion of the wrong sample or mislabeled digestate, poor digestion technique, improper concentration calculation, and data reporting or transcription error. These factors, as opposed to a suspected spectral interference, are a much more plausible scenario for the discrepancy between the API total and TCLP leachate arsenic results.

There was no evidence supporting Chevron's further contention of a positive bias existing with the EPA arsenic TCLP leachate data. Unlike the API samples, the EPA leachates were analyzed for arsenic using both GFAA and ICP. For the most part the results from these separate analyses compared favorably. In most circumstances the GFAA result was the reported concentration, however, for sample R7B-RC-01 the ICP result (34.0 mg/L) was reported since the GFAA analysis was performed on a leachate prepared beyond the recommended holding time. This particular ICP result was considered valid and unbiased given the acceptable laboratory QC results. Furthermore, the EPA total and TCLP arsenic results for sample R7B-RC-01 could probably be considered biased low based on the analytical data submitted from BP for a sample of the same catalyst collected three weeks prior to the EPA sample. The BP reported total and TCLP arsenic concentrations were 3,730 mg/kg and 122 mg/L, respectively.

In conclusion, the problems observed by the commenter with API's split sample arsenic analysis

were not present in EPA's analysis.

**Comment 4:** The risk assessment for spent hydrotreating and hydrorefining catalysts managed in Subtitle D landfills overstates risks from benzene and arsenic (the only constituents of concern) because EPA included benzene and arsenic concentrations in excess of the TC limit for these compounds in its characterization of residuals managed in Subtitle D landfills. However, such residuals would be characteristically hazardous and could not legally be disposed in Subtitle D facilities. Inclusion of these data in the assessment of risks from Subtitle D landfilling causes the risks from these two compounds to be vastly overstated. (API, 00046; Mobil, 00033; NPRA, 00015; Phillips, 00055; Sun, 00034; Valero, 00051)

**Response:** EPA's analysis of the six hydrotreating and three hydrorefining catalyst samples showed that five of the nine samples exhibit the Toxicity Characteristic. All of these samples were considered in the risk assessment, without consideration of the TC threshold. The sampled facilities gave EPA no indication at the time of sampling (or subsequently) that the wastes were destined for Subtitle C management, or that they were inappropriate for inclusion in the risk assessment data set. In addition, the TC is not a required analysis; generators can use their knowledge of their wastes to determine whether or not the wastes are likely to exhibit any of the characteristics. By assuming a worst case (i.e., the generators underestimate risk and do not always conduct definitive testing), the Agency was able to assess whether hydrotreating and hydrorefining catalysts should be listed as hazardous regardless of TCLP results.

However, in response to the commenters' concerns, EPA did rerun the risk assessment analyses capping the TCLP concentrations at the TC thresholds. These analyses were presented in the April 8, 1997 NODA (see Table II of the NODA), and re-run to reflect changes in the landfill size and active life assumptions after consideration of NODA comments (see Additional Groundwater Pathway Analyses, Supplemental Background Document, 1998, in the docket for the final rule). While this analysis did reduce the risks associated with benzene and arsenic for these residuals, the remaining risks are within EPA's discretionary range as summarized in the table below.

Comparison of Groundwater Risks for Petroleum Residuals in Off-Site Landfills<sup>165</sup>

Waste	Constituent	Revised Risks		TC-Capped Risks	
		High-End Risk	Monte Carlo Risk (95th%)	High-End Risk	Monte Carlo Risk (95th%)
Hydrotreating Catalyst	benzene	1E-04	3E-05	3E-05	9E-06
	arsenic	8E-05	2E-05	8E-05	2E-05

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<sup>165</sup>Risk represented for off-site landfills; on-site risks were somewhat lower.

Waste	Constituent	Revised Risks		TC-Capped Risks	
		High-End Risk	Monte Carlo Risk (95th%)	High-End Risk	Monte Carlo Risk (95th%)
Hydrotreating catalyst	benzene	7E-05	2E-05	3E-05	8E-06
	arsenic	6E-04	4E-04	6E-04	4E-04

These results confirm the Agency's findings that spent hydrotreating and hydrotreating catalysts should be listed as hazardous wastes.

### 3. Risk Assessment

**Comment 1:** EPA data shows that 81% of hydrotreating and hydrotreating catalyst is already recycled or reclaimed. Yet EPA assumes that all of this material will go to landfills in its risk analysis. (API, 00046, Chevron, 00050; Mobil, 00033; Sun, 00034)

**Response:** While EPA agrees that the §3007 Questionnaire data show that much of the spent catalyst was being recycled, EPA decided to conduct its groundwater risk analysis by assuming that the recycled material may go to landfill disposal because of economic considerations and other information available in the record. To calculate waste volumes to use as input to the modeling, EPA did examine the volume data two ways: (1) EPA arrayed the volumes disposed in on-site and off-site Subtitle D landfills in 1992 and determined the 50th and 90th percentile quantities (Tables 3.3.4 and 3.3.11 of the 1995 Listing Background Document for the 1992-1996 Petroleum Refining Listing Determination), and (2) EPA arrayed the volumes for *all* volumes generated by any facility regardless of the final management method (except for excluding wastes sent to Subtitle C), and determined the 50th and 90th percentile quantity generated by any facility in 1992, regardless of the final management method. The commenter correctly notes that EPA used the second set of statistics in the risk assessment for the proposed rule (and in subsequent analyses as well). Use of these data reflect the real potential that shifts might occur in management practices away from recycling and toward less expensive landfilling if the wastes are not listed (see Listing Background Document for the 1992-1996 Petroleum Refining Listing Determination, 1995, pp. 78-79). Further support for this assumption may be found in industry comment, which noted that refineries may send spent catalysts to either recycling or landfill disposal, depending on the associated costs. Furthermore, during site visits to both refineries and catalyst recyclers, EPA learned that factors affecting spent catalyst management include the price of metals, and consequently the value of spent catalyst, and corporate policies toward recycling versus landfilling. For example, one report from a visit to a refinery (document # 95-PRLP-S0041) states "the spent catalyst is sent offsite for metals reclamation or to a special waste landfill, depending on market conditions." Another report from a site visit to a reclaimer (95-PRLP-S0057) states the company's fee structure is driven by metals prices, and their costs and/or credits are dependant on the current metals market. The reclaimer noted that more spent catalyst

is reclaimed when metal prices are high then when prices are low. EPA therefore believes that management patterns of these particular residuals could change in the future. EPA only applied this assumption to three wastes (K171, K172, and spent catalyst from sulfur unit tail gas treating units), because these are all similar spent catalysts that are recycled in the same manner.

EPA believes this approach for calculating waste volume distributions was justified, but points out that a comparison of the two data sets shows the commenters' concern that the approach used overestimates risks is unfounded. The high-end (90th percentile) annual volumes calculated for both approaches are nearly identical for hydrotreating catalyst; the 70 MT respectively for the first approach 77 MT for the second. For hydrorefining catalyst, use of volumes that are recycled actually reduced the high-end volume somewhat, from 2,250 to 500 MT. Thus, EPA's approach does not in any way overestimate risks.

**Comment 2:** EPA fails to consider on-site stabilization techniques currently used by refineries sending catalyst to disposal. This technique adds cement to prevent rapid oxidation and minimizes metals leaching. Thus, transportation and handling of this treated catalyst going to disposal are safe. (API, 00046; Chevron, 00050; Sun, 00034)

**Response:** In response to these comments, EPA reviewed its information from sampling trips and the RCRA 3007 questionnaires<sup>166</sup>. EPA found that six refineries reported some type of onsite or offsite stabilization of K171/K172 in any year. As the commenter suggested, these refineries ultimately disposed of the spent catalyst. However, the Agency has no record sampling data for stabilization techniques of spent catalysts. In addition, the results of the questionnaire show that stabilization is not widely or commonly used in the industry for spent catalysts (i.e., only 2 K171/K172 wastes out of 55 such landfilled wastes were stabilized in 1992) and the Agency does not know the feasibility of other refineries' successful implementation of stabilization for these wastes. Generators utilizing these techniques will be able to submit delisting petitions under 40 CFR 260.20 and 260.22, if they believe the resulting residuals are no longer hazardous.

**Comment 3:** Benzene and arsenic were the only two compounds identified as constituents of concern for spent hydrotreating and hydrorefining catalyst. The ground-water risks (i.e., the sole plausible risks) associated with these compounds in on-site and off-site landfills range between  $6 \times 10^{-5}$  and  $2 \times 10^{-7}$ . Although high-end risks are within EPA's range of concern, these values are certainly not in the range considered a presumptive listing (greater than  $10^{-4}$ ).

In the case of spent hydrotreating catalyst and spent hydrorefining catalyst, factors 2 and 3 of EPA's Hazardous Waste Listing Determination Policy (59 FR 66073, Dec. 22, 1994) provide compelling reasons not to list these residuals. First, any potentially substantial risks associated with landfilling of these residuals are adequately covered under the existing TC regulation [see Section IV.C.2, Comment 1]. Second, the risk assessment for spent hydrotreating catalyst and

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<sup>166</sup> "Additional Listing Support Analyses for the Petroleum Refining Listing Determination," 1998.

spent hydrotreating catalyst managed in Subtitle D landfills overstates risks from benzene and arsenic (the only constituents of concern) because:

- EPA included benzene and arsenic concentrations in excess of the TC limit for these compounds in its characterization of residuals managed in Subtitle D landfills. However, such residuals would be characteristically hazardous and would be subject to Subtitle C LDR treatment standards before any land disposal. Nor could such wastes legally be disposed of in a Subtitle D landfill if they exceed the TC Limits. Inclusion of these data in the assessment of risks from Subtitle D landfills causes the risks from these two compounds to be vastly overstated. [see Section IV.C.2, Comment 4]
- EPA did not consider the biodegradation of benzene in its estimate of risks from Subtitle D landfills of spent hydrotreating catalyst and spent hydrotreating catalyst. [see Section IV.C.4, Comment 1]
- EPA employed an overly conservative infiltration rate in its leachate model. [see Section IV.C.3, Comment 4]

For spent hydrotreating catalyst, the annualized cancer incidence rate was calculated to be equal to 0.00003 cases/year for persons living within 1 mile of an off-site landfill containing spent hydrotreating catalyst (EPA, 1995. Petroleum Refining Listing Determination. Background Document for Groundwater Pathway Analysis. U.S. EPA, Office of Solid Waste, p. 42). [see Section IV.C.7, Comment 1] (API, 00046; Mobil, 00033; NPRA, 00015; Phillips, 00055; Valero, 00051)

**Response:** EPA continues to believe that it is appropriate to finalize the spent catalyst listings. First, even when EPA's samples which failed the toxicity characteristic were capped at the TC limits, the risk assessment calculations still indicated risk is present. Secondly, these residuals pose risk due to their self-heating nature. Third, EPA's record shows a 40 percent toxicity characteristic failure rate. Because the toxicity characteristic allows generators to use their "knowledge" rather than testing, to determine hazard, the characteristic does not provide as strong an assurance as listing under Subpart D that these materials will be managed as hazardous. Furthermore, EPA has become aware of additional damage cases, available in the docket, where a refinery shipped its catalyst as nonhazardous despite lab results showing that the catalyst was characteristic for benzene (see F-97-PRA-S0037). Finally, the revised risk assessment, as described in the April 8, 1997 NODA, showed even higher risk than the levels used to support the proposed listing determination in November, 1995. Additional specific responses to the comment are provided in the sections noted above.

**Comment 4:** The risk assessments for these residuals overstate the potential risk from arsenic and benzene because they use an overly conservative infiltration rate. The median value used by EPA resembles the worst case that could be expected at a landfill. Assuming saturated conditions is overly conservative and ignores the fact that most landfills by design have covers to divert

precipitation. (API, 00046)

**Response:** See Section III.N of this response to comment document.

**Comment 5:** Through a series of flaws in methodology and inappropriate modeling assumptions, EPA's risk assessment vastly understates the risks posed by refinery wastes in this rulemaking. Included among these flaws are (1) the use of the TCLP values as inputs to the landfill groundwater modeling despite the procedure's ineffectiveness on oily wastes (see Comment 6 below), (2) the failure to consider co-disposal and the potential for free phase flow (see Comment 7 below), (3) the dermal and inhalation effects associated with contaminated groundwater usage (see Comment 8 below), and (4) the use of the arsenic MCL as the HBN (see Comment 9 below). When the various deficiencies are corrected, the risk levels posed by the mismanagement of spent catalyst from hydrotreating or hydrorefining operations will vastly exceed presumptive listing concentrations. The listing of these two wastes as hazardous is clearly warranted. (EDF, 00036)

**Response:** EPA agrees that the listing of spent hydrotreating and hydrorefining catalysts is warranted, although EPA does not agree with all of this commenter's arguments as described further in Comments 6 through 9 below and elsewhere in this response to comments document.

**Comment 6:** EPA inappropriately used the TCLP values as inputs to the landfill groundwater modeling despite the procedure's ineffectiveness on oily wastes.

**Response:** As discussed in detail in Section III.H, EPA remains convinced that it is appropriate to use the TCLP to characterize these residuals and to use TCLP results as input to the groundwater risk assessment. The specific results for the catalysts showed oil and grease content of less than 0.2 percent for the six samples for which EPA was able to conduct total oil and grease analysis (see Table 1 of Supplemental Background Document, Listing Support Analyses, 1997).

**Comment 7:** EPA failed to consider co-disposal and the potential for free phase flow.

**Response:** EPA did not assess the impact of co-disposal of the catalyst residuals with other refinery wastes (see Comment 3 of Section III.I) because the results of the revised NODA and final risk assessment showed sufficient risk to support promulgation of these listings. EPA did not further consider the potential for free phase flow because none of the available data indicate that these residuals contain free oil. See Sections III.H and K of this document, as well as Section I.C.1 of the NODA Response to Comment Document for further discussion of the potential for free phase flow.

**Comment 8:** EPA failed to consider the dermal and inhalation effects associated with contaminated groundwater usage.

**Response:** The risk assessment results for the final rule do include consideration of dermal and inhalation risks associated with contaminated ground water. See Section III.O of this document

for discussion of this issue.

**Comment 9:** EPA inappropriately used the arsenic MCL as the HBN.

**Response:** The groundwater risks calculated for arsenic were based on an HBN of  $3.0 \times 10^{-4}$  (0.0003) mg/l, not on the MCL which is equal to 0.05 mg/l.

#### 4. Biodegradation

**Comment 1:** EPA failed to consider the biodegradation of benzene in its estimate of risks from Subtitle D landfilling of spent hydrotreating catalyst and spent hydrorefining catalyst. (API, 00046; Mobil, 00033; NPRA, 00015; Phillips, 00055; Valero, 00051)

**Response:** Section III.D of this document contains EPA's reasoning regarding its decision not to consider biodegradation in the ground-water pathway analysis.

#### 5. Projected Impact of Listing on Recycling and Management Practices

**Comment 1:** A significant fraction (81%) of spent hydrotreating and hydrorefining catalyst is currently recycled. Designating these materials as listed hazardous wastes will discourage existing recycling by making it less economical than disposal.

Moreover, listing this material as hazardous will remove the existing incentives to minimize risks prior to shipment and handling of the material. This, in turn, will increase risk to human health and the environment. Designating this spent catalyst as a listed waste will remove any incentives for a generator to operate his process to remove these characteristics **prior** to generation and offsite shipment to a reclaimer.

The current high level of recycling has been achieved without listing these catalysts as hazardous wastes due, in part, to the economics of reclamation vs. disposal, as well as to refiners' preference for pollution prevention and concern about potential long term liability from disposal. However, listing the catalysts as hazardous would profoundly alter the current balance of considerations (which, on the whole, currently results in substantial recycling) by disproportionately increasing the costs of and increasing liability concerns about recycling.

Spent catalyst can be generated such that it meets the LDR universal treatment standard for organics. Thus, the only treatment required for hazardous waste disposal is fixation of metals which is relatively inexpensive. This results in a low cost of hazardous waste disposal compared to the significantly increased cost of recycling that results from this listing.

By listing these wastes, however, transportation costs become a significant cost factor as materials will need to be transported as hazardous regardless of their characteristics. Higher transportation costs will strongly favor local disposal as the distance to a recycler is typically



many times further than that to a Subtitle C landfill.

As these catalysts will all have to be managed as hazardous waste, facilities will need special transportation containers (Type 56, DOT intermediate bulk containers) and no longer be able to manage these materials in larger more efficient tandem end dump containers. This will increase the cost of transportation, again favoring more local disposal options. It will also limit a reclaimer's capacity to receive and process these materials, increasing the costs per volume of catalyst.

The processing cost for metals reclaiming will increase due to:

- the increased cost of storage and handling of the catalyst and its residuals as hazardous waste,
- RCRA and state permit requirements for storage,
- increased liability concerns and related insurance costs, and
- shrinking in the number of catalyst recyclers (since not all recyclers are permitted to receive hazardous wastes).

Many of the generators of the 81% of spent catalyst going to reclamation or regeneration will likely find Subtitle C landfills more cost effective and secure if these materials are designated as listed hazardous wastes.

In addition, the difficulties of permitting to receive and manage these materials as hazardous will make the catalyst reclaiming market less attractive. Some reclaimers will exit the business and others will not enter who might have otherwise. The liability implications of getting a RCRA permit will certainly force many to reconsider their involvement in this market. The implications of the mixture and derived from rules may rule out the use of many potential recyclers. The net effect is to raise the cost of recycling these materials. The cost of disposal will become increasingly attractive. (API, 00046; ARCO, 00023; BP Oil, 00019; Chevron, 00050; Exxon, 00035; Mobil, 00033; Phillips, 00055; Sun, 00034; Texaco, 00049)

**Response:** At the time EPA conducted its industry study and visited several catalyst reclaimers, land disposal was less expensive than recycling, yet as the commenters noted, more than 80 percent of the catalyst volume was recycled. Obviously there are incentives at play beyond the immediate recycling/disposal cost differential. At the time of EPA's study, refineries described these incentives to include liability reduction (because recycling converts virtually all of the catalyst components to saleable products with minimal residuals requiring disposal), as well as corporate commitments to waste minimization principles. Because of the listing, Subtitle D landfilling will not be possible, and the recycling/disposal cost differential will likely be reduced or reversed when BDAT and Subtitle C disposal costs are considered. Thus, EPA believes that recycling is likely to continue to be an effective management option for these residuals.

EPA disagrees with the commenter's claim that pre-shipment treatment would no longer occur.

In EPA's field investigation supporting this rulemaking, EPA held extensive discussions with a number of refineries regarding the generation and management of spent catalysts, and the risks associated with these materials, as described in the 1995 Listing Background Document for the 1992-1996 Petroleum Refining Listing Determination. It is EPA's understanding that *in situ* treatment serves a dual purpose to reduce occupational hazards to staff and contractors conducting the change out, and to generate a non-characteristic residual. Generators will still need to control the considerable occupational hazards associated with reactor changeouts, and thus would be expected to be just as cautious after the promulgation of this rule as they were before.

Further, EPA believes that the liability concerns described will continue to play in both landfilling and recycling decisions upon promulgation of this rule. EPA is not attempting to manipulate market forces to drive decisions to recycle through this rulemaking, which is primarily a rule that differentiates between listed and non-listed refinery residuals. It is a logical outcome of new listings, however, that the affected industry first explores means to eliminate or minimize the newly listed waste, and then to optimize treatment and management of remaining wastes. EPA expects that this outcome will be observed over the next several years with these newly listed wastes. The basis of EPA's decision, however, centers on the results of its risk assessment, which demonstrates that these materials pose a potential risk to human health and the environment, and warrant Subtitle C control.

Further, EPA agrees that under recent market conditions, recycling has been economically less attractive than landfilling (especially Subtitle D landfilling), although many facilities elect to recycle their waste in any case. It is not EPA's intent to encourage landfilling at the expense of recycling. While recycling costs may increase as a result of this rule, EPA continues to believe that it is completely appropriate to bar these materials from Subtitle D disposal because of the risk levels identified through the Agency's risk assessment procedures. While EPA would prefer that the high levels of recycling would continue after promulgation of this rule in keeping with its waste management hierarchy, Subtitle C landfilling clearly provides better protection than Subtitle D landfilling.

EPA also agrees that the costs associated with Subtitle C management are more burdensome than costs for nonhazardous wastes. Waste management and transportation prices are established by the open market and are higher for hazardous waste because of the additional services provided and risk assumed by the management and transportation firms. However, the Agency points out that a significant number of refineries currently bear the cost of transporting their residuals long distances to reclaimers, despite the availability of closer and less expensive Subtitle D landfills. Thus EPA does not believe the commenter's argument bear serious further consideration. EPA does not believe that an increased cost burden is an appropriate basis for not listing residuals, when the Agency's risk assessment models and tools indicate that these materials pose a risk to human health and the environment.

With respect to the commenters' concern about diminished access to recycling, the Agency is

unconvinced. Based on EPA's discussions with the recycling industry, many of the reclaimers currently have RCRA storage permits to allow them to manage characteristically hazardous catalyst. EPA's data indicates that 30 percent of all catalysts were described by the generators as hazardous. Data from CRI-MET indicates that more than 25 percent of the incoming catalysts from April 1992 to March 1995 were manifested as hazardous. (See Listing Background Document for the 1992-1996 Petroleum Refining Listing Determination, 1995, pages 76-79). These facilities certainly will require permit modifications to accommodate the listings, but EPA is aware of only one reclaimer who currently refuses to accept hazardous wastes. While recycling costs may increase as a result of this rule, EPA believes that it is completely appropriate to bar these materials from Subtitle D disposal. Further, EPA is finalizing an exemption at 261.3(c)(2)(ii)(E) for catalyst support media separated from the spent catalysts. This exemption will lessen the potential ramification of the mixture and derived from rules to reclaimers.

EPA does not agree with the commenters' scenario for several reasons. First, the treatment standards for the spent catalysts require that any treatment reduce levels of organics to low levels. For example, nonwastewater levels of benzene, toluene, and xylene must be 10 mg/kg or lower, and levels of naphthalene and phenanthrene are set at 5.6 mg/kg. Because the K171 and K172 wastes each frequently contain reactive sulfides and as a result may exhibit self-heating pyrophoric properties, the Agency also listed reactive sulfides as one of the hazardous constituents of concern in these wastes and specifically proposed to apply deactivation to these wastes. Thus, EPA does not believe it is likely that generators can meet all applicable LDR standards without appropriate treatment, such as treatment at a recycling facility. EPA concedes that listing may increase costs for recycling, however, EPA is not convinced that costs for other forms of treatment and disposal would be appreciably less. In any case, EPA's decision to list these materials is based on the risks they pose, and how this listing may ultimately affect competing treatment technologies is not a central issue in the Agency's decision.

**Comment 2:** EPA expresses a concern about landfill fires related to the self-igniting characteristic of the spent catalyst. Discussions with various commercial landfills indicate that there have been no fires related to these catalysts and that landfills already have the authority and the operational interest to screen for and treat any such material prior to disposal. They are also free to reject such materials. It makes little sense to cause all catalyst handling to be regulated as hazardous simply because of a theoretical landfill operational problem that could be easily remedied outside of Subtitle C. A careful review of any incident(s) involved are likely to yield solutions less drastic than an industry wide hazardous waste listing. (API, 00046; Chevron, 00050; Exxon, 00035)

**Response:** As part of the field investigations supporting this rulemaking, EPA conducted several site visits to catalyst reclaimers. At each of these facilities, EPA observed smoking catalyst storage areas used to stage the catalysts immediately prior to insertion into the reclamation process. At one facility, the ambient temperature near the pile was elevated and the facility told EPA during the site visit that fires occur every few months. These areas were carefully monitored and controlled, but clearly the materials exhibited pyrophoric properties. In addition, EPA

discussed with the refineries studied in the field investigation the catalyst handling practices employed at each of these facilities. Repeatedly, the refineries described the significant risks that they manage during reactor turnaround associated with the potential pyrophoric nature of these catalysts, including the extensive use of inert gas blankets within the reactors and on top of the spent catalysts within the flowbins used to transport the catalysts off site. The conditions within hydroprocessing reactors can result in the generation of ferric sulfide as trace water reacts with the piping and reactor walls in the presence of sulfur contaminants. Exposure of ferric sulfide to oxygen results in potentially explosive conditions and the release of sulfur dioxide. EPA therefore believes that it has solid basis for using the potential self-igniting characteristic of these catalysts to support its decision to list these residuals.

As EPA was preparing for the proposed rule, one of the catalyst reclaimers submitted a study which it had coauthored regarding the use of heavy oils as catalyst coatings to reduce pyrophoric characteristics.<sup>167</sup> This study showed that for as long as the coating remained intact, the self-heating nature of the material was reduced due to the reduction of oxygen exposure to the catalyst (and deposited ferric sulfides). The study also demonstrated that this effect is not permanent as the oil coating degrades. Thus, EPA believes that it is possible that landfills might receive spent catalysts treated to reduce pyrophoric properties which become more hazardous over time, particularly if the material is disturbed at a later date and exposed to the air after the protective oil coating has degraded in some manner.

**Comment 3:** High concentrations of arsenic are prevented from accumulating on the catalyst through catalyst selection and bed design. If the incentives for avoiding a TC hazardous level are removed by virtue of a listing then this will no longer be a factor in bed design and arsenic will become more common. Removing these characteristics prior to shipment is an important risk reducing activity. If the catalyst is going to be managed as hazardous regardless of how it is generated there will be few incentives to remove the most hazardous characteristics. (API, 00046; Chevron, 00050; Phillips, 00055)

**Response:** EPA believes that the primary reason that refiners minimize arsenic accumulation in the catalyst bed through catalyst selection and bed design is because arsenic is a catalyst poison and minimization of arsenic contamination increases the time span between catalyst changeouts. Avoiding the TC upon spent catalyst generation is likely to be a secondary reason and maximizing time spans between turnarounds will always be a primary consideration in hydroprocessor operation. In fact EPA found that two of the three hydrorefining catalyst samples it collected exceeded the TC limit of 5 mg/L for arsenic at 34 and 6.9 mg/L, and two of six hydrotreating catalyst samples were quite close to the TC limit at 4.9 and 1.5 mg/L. These data do not coincide with the commenter's claim that refineries avoid arsenic contamination in their hydroprocessing residuals.

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<sup>167</sup>Letter to William F. Brandes, EPA, from Richard Quinn, Catalyst Technology, Inc., May 12, 1995. Docket Number F-95-PRLP-S0059.

Further, it has been EPA's experience that listing wastes as hazardous raises the generators' consciousness of the potential risks associated with their residuals and the wastes subsequently are generated less frequently through application of pollution prevention techniques. In some cases (e.g., electroplating residuals) the wastes are reported to have become less hazardous over time due to changes in process and management practices.<sup>168</sup> In the case of the refining hydroprocessing catalysts, they will continue to pose risk to refinery personnel and contractors during reactor change out, and the Agency believes that the industry will be even more cautious than they already are as a result of the listing. This caution is likely to include the same arsenic reducing practices currently employed.

**Comment 4:** The self-heating potential of the catalyst is often removed prior to shipment. A significant volume of recycled catalyst is first oxidized or "weathered" on an impervious concrete pad to remove any self-heating potential prior to shipment off site. If the catalyst is listed as hazardous then there is no advantage or justification for removing these characteristics. Further these activities would be prohibited without a RCRA permit. (Chevron, 00050)

**Response:** EPA does not believe that refineries will stop safe management practices as a result of this listing determination. Safety concerns remain a paramount priority within the refining industry and the careful management of pyrophoric materials will continue to be a necessity after promulgation of this listing. Whether or not facilities continue to use weathering pads will be a function of whether or not they already are permitted or the refinery is willing to pursue permitting. Many refineries, however, manage these residuals without weathering, and EPA believes that the expeditious movement of this material off-site to appropriate management under safe conditions (e.g., under inert gas blankets) is probably preferable to weathering practices.

#### 6. Ignitability as a Basis for Listing

**Comment 1:** The listing or non-listing of these residuals should not be predicated in any part on the RCRA Characteristic of Ignitability. The current regulations clearly allow for the determination that a solid (not liquid) waste that has pyrophoric and self-heating properties to not be classified as D001 if it does not burn vigorously and persistently. Hydrotreating catalyst will not fail the RCRA ignitability characteristic, but must still be managed as a DOT hazardous material. These catalysts will not burn vigorously and persistently. The solids portion of this definition should be used for solid material such as catalyst. (Shell, 00047)

**Response:** Under existing RCRA regulation the characteristic of ignitability is applicable to solids that are capable of causing fire through spontaneous chemical changes "and, when ignited, burns so vigorously and persistently that it creates a hazard." In the case of spent hydrotreating and hydrorefining catalysts, persistent smoldering fires that may propagate to other codisposed

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<sup>168</sup>Cushnie, George C. Jr. Pollution Prevention and Control Technology for Plating Operations. Sponsored by the National Center for Manufacturing Sciences and National Association of Metal Finishers. 1994.

materials have been reported. Because such smoldering combustion lacks the vigor of sustained flames, generators have argued that such wastes are not D001, while others have concluded the wastes are nevertheless D001.

As the commenter notes, these spent catalysts would be classed under DOT regulation as spontaneously combustible materials due to their self-heating properties. However, DOT regulations would be inadequate to prevent the codisposal of these materials with flammable materials. The EPA in considering the criteria for listing hazardous wastes (see §261.11) believes it is appropriate to consider physical properties that may result in hazards if there is improper management (i.e., co-management with combustibles), the nature and severity of past damages (i.e., reported fires and process disruptions), and the applicability of other regulations such as DOT requirements and existing D001 definitions. Therefore, EPA presented the self-heating physical property of these spent catalysts in its proposal among those considered in the decision making process. EPA's ultimate decision to list the proposed wastes was based upon a weight-of-the-evidence considering all relevant factors: ground-water risk, propensity to exhibit the toxicity characteristic for benzene and arsenic, and self-heating properties.

**Comment 2:** The potential self-heating property of these catalysts is not a basis for listing. This issue is already adequately managed at refineries to ensure adequate personnel protection and compliance with air and hazardous materials regulations while on-site and Department of Transportation regulations during transportation. Commenters (i.e., refineries) are not aware of any incidents at its refineries, or other refineries, due to the self-heating property of these spent catalysts. (ARCO, 00023; Mobil, 00033)

**Response:** See response to Comment 1 above.

#### 7. Other Miscellaneous Considerations

**Comment 1:** EPA's proposed listing of spent hydrotreating/hydrorefining catalysts is not supported by EPA's own analysis. EPA concludes in their risk analysis that the "incremental risk in terms of cancer cases avoided would be near zero." There is no benefit to listing hydrotreating/hydrorefining catalysts as listed hazardous wastes. (API, 00046; NPRA, 00015; Total, 00039; Valero, 00051)

**Response:** EPA's primary response to comments regarding population risks can be found in Section IV.B of the NODA Response to Comments Document in the docket.

**Comment 2:** A refinery is concerned that the Agency has based too much reliance on anecdotal comments from some spent hydrotreating/hydrorefining catalyst reclaimers who would gain competitive advantage within the catalyst reclamation industry if this listing were to become final. The cost of doing business for refiners can only increase if this listing proposal becomes final and would at best maintain the status quo if a no-list decision were made. However, certain reclaimers stand to gain significant competitive advantage over other reclaimers and considerable

pricing leverage for their services if this proposal is finalized. Given this situation, the Agency should examine the claims of certain reclaimers with something of a "jaundiced eye." (Mobil, 00033)

**Response:** Regardless of the claims of industry and the recycling industry regarding costs of residual management with and without a final listing decision, EPA believes the wastes merit designation as hazardous under 40 CFR 261.

#### **D. CATALYST FROM SULFURIC ACID ALKYLATION**

**The Agency requested comments on its proposal to continue the current regulation of spent sulfuric acid that is not used to produce virgin acid (i.e., as a characteristically hazardous waste when discarded)**

**Comment 1:** This residual is currently exempt from the definition of solid waste and from regulation when used to produce virgin sulfuric acid in 40 CFR 261.4(a)(7). The commenters support EPA's determination that this practice is used overwhelmingly in the industry and is a sound method of management that should not be changed or affected by unnecessary regulation. (Mobil, 00033; Sun, 00034)

**Response:** EPA acknowledges the commenters' support.

**Comment 2:** The minor losses of this residual (spills to wastewater treatment units, etc.) which are not used to produce virgin sulfuric acid do not justify listing. In addition, this material, if managed as a waste, would be a corrosive characteristically hazardous waste and therefore listing would be unnecessary. (Sun, 00034)

**Response:** EPA believes that refineries have significant incentive to minimize non-recyclable losses of spent acid as reflected by the extreme pH of this material, and the fact that very little losses were reported in the 1992 survey.

**Comment 3:** The spent sulfuric acid recycling process most resembles a manufacturing operation, and the commenters fully support the EPA's decision not to list catalyst from sulfuric acid regeneration. (General Chemical, 00017; PVS Chemicals, 00013; Rhone-Poulenc Environmental Services North America, 00014)

**Response:** The Agency acknowledges the commenters' support.



## **E. SPENT CAUSTIC FROM LIQUID TREATING**

### **1. Comments Supporting Exclusion and No-list Decision**

**Comment 1:** Commenters support the proposed exclusion for spent caustic used in the production of cresylic and naphthenic acids and agree with EPA's findings related to the exclusion. (ARCO, 00054; Caufield, 00009; , 00031; Merichem, 00060; Mobil, 00033; Sun, 00034; Total, 00039)

**Response:** The Agency acknowledges the commenters' support.

**Comment 2:** Listing as a hazardous waste would trigger much additional fees and costs from both government and in its handling. These additional costs are likely to stop this positive practice of use as a feedstock in the manufacture of cresylic and naphthenic acid products. (Caufield, 00009)

**Response:** EPA's decision making regarding this residual was primarily driven by the definition of solid waste issues described in the proposed rule (60 FR 57769-57770). While the commenter's assertion may be true, it was not critical to the Agency's decision making process.

**Comment 3:** Commenters agree with EPA's findings that this use of these materials most closely resembles a manufacturing process and not waste management. (API, 00046; CMA, 00018; Merichem, 00060; Mobil, 00033)

**Response:** The Agency acknowledges the commenters' support.

**Comment 4:** This residual, if managed as a waste, would be characteristically hazardous (for corrosivity and/or toxicity for cresol). As a result, listing is unnecessary since appropriate hazardous waste management requirements apply. (ARCO, 00054; Sun, 00034)

**Response:** EPA agrees that for this waste, the characteristics (primarily corrosivity, as well as the toxicity characteristic) provide broad coverage of this wastestream, and obviate the need for a specific listing.

**Comment 5:** Spent caustic presently is beneficially reused at various facilities as a neutralizing agent. Due to the mixture and derived-from rules, some of these activities could be unnecessarily precluded if this waste stream were to become a listed hazardous waste. (Amerada Hess, 00027)

**Response:** EPA's decision making regarding this residual was primarily driven by the definition of solid waste issues described in the proposed rule (60 FR 57769-57770).

**Comment 6:** The commenters agree with the Agency's assessment that any discharges of spent caustic to wastewater treatment systems are adequately and appropriately regulated under other

regulations. (Amerada Hess, 00027; Total, 00039)

**Response:** The Agency acknowledges the commenters' support.

2. Comments Against the No-List Decision

**Comment 1:** EPA only evaluated potential risks from the air pathways associated with tank storage, and thus no assessment of potential groundwater impacts was considered. EPA must evaluate the potential groundwater impacts from surface impoundment management, since that method of management is both an actual and plausible mismanagement scenario.

Even though several refineries reported managing spent caustic from liquid treatment in surface impoundments in 1992, EPA only assessed the risks posed by tank management and thus completely ignored the potential groundwater risks from waste mismanagement. EPA's high-end volume estimates of 596 MT managed in surface impoundments exceeds the volumes associated with practices EPA did model for other wastes.<sup>169</sup>

EPA does not claim the practice is "rare." Instead, EPA suggests the risks posed by surface impoundment management would be addressed in large part by the Phase III and Phase IV LDR rulemakings.<sup>170</sup> However, the controls on surface impoundments proposed in that rulemaking will not be finalized, in part due to Administration support for a statutory amendment terminating that rulemaking. Therefore, EPA lacks any rationale for not evaluating the disposal of spent caustic from liquid treating in surface impoundments.<sup>171</sup> (EDF, 00036)

**Response:** A few points of clarification are required. First, EPA agrees that surface impoundment management occurs, but in every case described in the 1992 database, these surface impoundments were part of the refineries' wastewater treatment systems. EPA has no data indicating that undiluted caustics were managed in surface impoundments. Second, EPA *did* conduct a screening analysis of the impact spent caustic would have on the wastewater treatment plant, as described in the docket to the proposed rule, but found that the dilution with other process waste waters was so great that no impact was observed.<sup>172</sup>

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<sup>169</sup>1995 Listing Background Document at 151.

<sup>170</sup>1995 Listing Background Document at 153.

<sup>171</sup>Since the volume reported for onsite surface impoundment disposal was separate from the volume reported for discharge into the wastewater treatment system, EPA should not simply assume that the surface impoundment disposal reported in 1992 would have been covered by the Phase III and Phase IV LDR rules.

<sup>172</sup> Page 152 of the 1995 Listing Background Document for the 1992-1996 Petroleum Refining Listing Determination.

EPA was not convinced by the commenter's arguments that additional risk assessment was necessary. The surface impoundments reported are integral parts of refinery wastewater treatment systems and are not used for management of un-diluted caustic. In addition, the constituents of concern (relatively low levels of certain volatile organics and metals, see the 1995 Listing Background Document for the 1992-1996 Petroleum Refining Listing Determination for details) in these residuals are generally indistinguishable from those found in other residuals typically discharged to wastewater treatment, making it virtually impossible to attribute any subsequent concentrations in sludges or environmental releases to the contribution from spent caustics.

EPA reexamined the potential impact of discharge to wastewater treatment systems, and found that the 90th percentile quantity of spent caustic discharged to wastewater treatment in 1992 was approximately 4,000 MT, or approximately 1 million gallons. While the 1992 survey did not collect extensive data about refinery wastewater treatment systems, such data were collected in the 1983 survey. The Agency consulted the 1983 §3007 survey for further information about the refinery associated with the 90th percentile volume of 4,000 MT, and found that the refinery had reported daily discharges of 7,920,000 gal/day in 1983. Assuming for the purposes of a rough screening analysis that significant changes in this refinery's wastewater treatment plant were not implemented between 1983 and 1992, these data can be used to calculate a caustic dilution to 0.035 percent of its original concentration (a factor of about 3,000), in addition to any treatment of constituents that occurs.

Risks associated with sludges resulting from the treatment of spent caustic mixed with other refinery wastewaters cannot be easily linked to the original spent caustic because of the prevalence of the contaminants of concern in many other refinery wastewaters. The Agency continues to argue, however, that significant regulatory control of these caustic-derived sludges already exists. Sludges from primary oil/water/solids removal surface impoundments are already regulated as hazardous in the petroleum refining industry, through the F037/F038 listings, and wastewaters are subject to the benzene characteristic D018. Therefore the risks of waste management in the initial units of a refinery wastewater treatment train have been separately evaluated for their risks in the prior regulations. Attributing the source of potential risks for wastes carried through to the remaining downstream units that are not covered by existing listings (i.e., aggressive biological treatment units and subsequent polishing units) is further complicated by mechanisms such as biodegradation and deposition, and was not attempted in this study. While the risks associated with these units should be reduced as a result of biodegradation, regulatory controls do exist for these sludges and wastewaters via the Toxicity Characteristic.

In addition, the benzene NESHAP (55 FR 8292, March 7, 1990) and the planned air standards for volatile organics emissions (MACT standards proposed in 61 FR 17358, April 19, 1996) provide regulatory mechanisms for control of air emissions that might arise from release of the key volatile constituent of concern (benzene), and wastewater discharges are covered by the NPDES program.

EPA does agree that it is no longer appropriate to rely on the regulatory controls originally anticipated via the Phase III and IV land disposal restrictions. The Land Disposal Program Flexibility Act of 1996 overruled the Third Third court decision with respect to management of "decharacterized" wastes (waste that had been characteristically hazardous, but were treated so that it no longer was characteristic) in centralized wastewater management systems. The Act caused the Agency to withdraw the LDR Phase III treatment standards for such decharacterized wastes (see 61 FR 15660, April 8, 1996), and not to finalize the proposed LDR Phase IV provisions for potential leaks, sludges and air emissions from surface impoundments treating decharacterized wastes (see 62 FR 25997, May 12, 1997). However, as required under the Act, EPA is currently conducting a 5-year study of surface impoundment usage, and if the study indicates that risks from impoundments are significant, EPA will then consider the need for further regulatory controls.

**Comment 2:** EPA's sampling indicates spent caustic from liquid treating "consistently exhibits" the toxicity characteristic for one or more creosols, and/or the corrosivity characteristic. Industry reported more than 64,000 MT of the waste was hazardous, and a portion of that amount exhibited the toxicity characteristic for benzene and/or the reactivity characteristic as well. EPA's sampling data indicates the presence of phenols at very high concentrations. Given the propensity for this waste to exhibit a hazardous waste characteristic, it should be listed as hazardous pursuant to EPA's listing criterion in 40 CFR 261.11(a)(1). (EDF, 00036)

**Response:** EPA agrees that this residual frequently exhibits one or more of the characteristics, however, because the majority of caustic management practices are either exempt from regulatory control or are adequately regulated under other regulations (e.g., the characteristics), the Agency believes that listing as hazardous waste is not necessary. The Agency's description of spent caustic management practices was presented in the proposed rule (60 FR 57769-57770) and the 1995 Listing Background Document for the 1992-1996 Petroleum Refining Listing Determination.

EPA believes that in this case the characteristics (primarily corrosivity, as well as the toxicity characteristic) provide broad coverage of this wastestream, and obviate the need for a specific listing. Given the existing regulatory controls and management practices for this waste, EPA continues to believe that listing is not warranted.

**Comment 3:** By listing spent caustic from liquid treating, EPA would clearly discourage the direct placement of the waste in surface impoundments, because surface impoundment management would automatically trigger a series of retrofitting requirements and land disposal restrictions. Presently, these requirements may or may not be triggered, depending upon whether the particular waste exhibited a characteristic (a determination the generator can reach based solely upon his or her "knowledge" of the waste). (EDF, 00036)

**Response:** As discussed above, spent caustic is not placed directly into surface impoundments in an undiluted state. EPA's data indicate that all surface impoundments used for caustic

management were part of refinery wastewater treatment systems. Respondents reported in the §3007 survey that the caustic was sent to neutralization then to wastewater treatment or used as a pH adjuster at the wastewater treatment plant. Thus, the commenter's concern that caustics are being "directly placed in surface impoundments" reflects an incorrect interpretation of the 1992 data.

In response to the commenter's concern regarding knowledge that this residual exhibits a characteristic, EPA notes that this material is commonly acknowledged as corrosive ("caustic" is a term that means highly alkaline, which is one of the bases for the corrosivity characteristic), and managed in a manner to minimize corrosion problems during storage. In addition a high percentage of refiners reported identification of this residual as exhibiting one or more of the characteristics. The Agency believes that most generators of spent caustic are well aware of the potential for this residual to exhibit one or more of the hazardous waste characteristics, and manage their spent caustic accordingly.

**Comment 4:** In addition, a listing would ensure the hazardous constituents in the waste are effectively treated in wastewater treatment systems, instead of simply diluted and then released into the air, ground water, or unregulated sludge. EPA could use its authority to establish BDAT for the waste, coupled with appropriate exit levels established in HWIR for wastewaters and sludges, to fashion a regulatory framework that allows both effective treatment and protects human health and the environment from uncontrolled releases. (EDF, 00036)

**Response:** The risk assessment of the tank air release pathway, representing undiluted caustic in an open top tank, showed this scenario to present maximum risk estimates, at a bounding level, of less than one additional cancer case in a population of 1 million and hazard quotients less than one for all toxicants detected. (While bounding analysis showed some risks due to mercury, further analysis of the risks associated with mercury was not conducted because (1) an incorrect biotransfer factor was inappropriately used, and (2) mercury was of marginal risk for the extremely conservative bounding scenario.) See Assessment of Risks from the Management of Petroleum Refining Wastes: Background Document, October 1995. Because a bounding assessment, evaluating undiluted caustic, showed incremental risks at levels below concern, no further analysis was conducted.

### 3. Requests for Clarification and Additional Exclusions

**Comment 1:** The commenters believe the use in the manufacture of cresylic acid and naphthenic acid has always been exempted from the definition of solid waste under 40 CFR § 261.2(e)(1)(I). (API, 00046; CMA, 00018; Merichem, 00060; Mobil, 00033)

**Response:** The Agency and several states have been involved in a longstanding discussion with industry regarding the regulatory status of these materials. The promulgation of this rule presents EPA's final findings, all previous discussions notwithstanding.

**Comment 2:** Promulgation of the proposed specific exclusion might be read by some to indicate that up until now, these caustics have not been excluded. Such a reading could lead to wasteful disputes between industry and the various regulatory agencies. To avoid this, EPA should state expressly in the preamble to the final rule that the new, specific exclusion is intended merely to clarify existing law. (API, 00046)

**Response:** In the preamble to proposed rule, EPA stated that spent caustic from liquid treating, when used as an ingredient or substituted for virgin caustic is eligible for an exclusion from the definition of solid waste under 40 CFR 261.2(e). This exclusion is a generic exclusion from the definition of solid waste for secondary materials that are used or reused directly (i.e., without reclamation) as ingredients in an industrial process to make a product. The Agency pointed out in the proposed rule that the proposed specific exclusion for spent caustic from liquid treating was to clarify the application of the definition of solid waste to the secondary material. Today EPA is finalizing the exclusion, as proposed, in 40 CFR Section 261.4(a)(14) for spent caustic solutions from petroleum refining when used as feedstocks to produce cresylic or naphthenic acid. Once again, EPA clarifies in the preamble to today's rule that the specific exclusion promulgated today clarifies the application of the generic exclusion.

**Comment 3:** Clarification of the existing regulation related to the definition of solid waste would have eliminated the need for the exclusion. (Merichem, 00060)

**Response:** The Agency pointed out in the proposed rule that the proposed specific exclusion for spent caustic from liquid treating was to clarify the application of the definition of solid waste to the secondary material. Today EPA is finalizing the exclusion, as proposed, in 40 CFR Section 261.4(a)(14) for spent caustic solutions from petroleum refining when used as feedstocks to produce cresylic or naphthenic acid. Once again, EPA clarifies in the preamble to today's rule that the specific exclusion promulgated today clarifies the application of the generic exclusion.

**Comment 4:** The commenter requests that the Agency "identify" and consider additional spent caustics which could be beneficially utilized, if the regulatory language of the Agency's "commodity-like" materials exemption (feedstock exemption) were expanded to include additional processes which rely on "incidental treatment" of secondary materials, such as spent caustic solutions from petroleum refining liquid treating processes. Current RCRA Subtitle C management standards for "incidental treatment" of spent caustics and other secondary materials deter "secondary" recycle/reuse of spent caustics. Such management restrictions significantly impact recycling efforts and limits a facility's ability to reduce manufacturing costs, and remain commercially competitive through the beneficial use of spent caustics. The commenters suggested the following proposed regulatory language (CRI, 00030; CRI-MET, 00031):

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(14) Spent caustic solutions from petroleum refining liquid treating processes used as a feedstock in a manufacturing process, when inserted directly or following reclamation unless the material is accumulated speculatively as defined in §261.1 (a) of this chapter.

**Response:** The Agency disagrees with the commenter's suggestion that the exclusion be broadened so that it would exclude not only spent caustics used directly as a feedstock to produce cresylic or naphthenic acid (as proposed), but also spent caustics that are to be reclaimed or otherwise incidentally processed prior to reuse in a variety of unspecified ways. The Agency views this suggestion as outside the scope of the exclusion that was proposed, which was limited to a specific chemical manufacturing process that utilizes approximately 17% of the spent caustic solutions identified by EPA as being generated from petroleum refineries (see 60 FR at 57769). The commenter's suggestion would undermine the general rule that spent materials that are to be reclaimed are defined as solid wastes under RCRA Subtitle C. These materials were already subject to subtitle C management standards even prior to being listed (because they exhibit a hazardous characteristic). In addition, a blanket exclusion for spent caustics that are to be reclaimed would allow the residuals from the reclamation process, that are disposed or abandoned, to potentially avoid being defined as listed wastes. Finally, the Agency notes that such an approach as suggested by the commenter is not needed for materials that have been completely reclaimed. As is the case with reclaimed solvents, the products are themselves not derived-from wastes. 40 CFR 261.3(c)(2)(I) provides that materials that are reclaimed from solid wastes and that are used beneficially are not solid wastes and hence are not hazardous wastes unless the reclaimed material is burned for energy recovery or used in a manner constituting disposal. Therefore, although spent caustic solutions that are reclaimed in a manner other than in the production of cresylic or naphthenic acid must be managed as a solid waste, and potentially a hazardous waste if they exhibit a characteristic, prior to reclamation, the reclaimed material is not a solid waste. Residuals from the reclamation process that are not used beneficially are solid wastes and potentially hazardous wastes if they exhibit a characteristic of hazardous waste.

The exclusion, as finalized, is restricted to spent caustic solutions from petroleum refining liquid treating processes *used as a feedstock to produce cresylic or naphthenic acid*.

Modeling Air Exposure: The Agency requested comments on its decision not to model air exposure pathways from wastewater treatment systems treating spent caustics due to benzene NESHAP and MACT standards. Specifically, EPA requested comments on the appropriateness of this decision with regard to lapses in coverage due to emission volume cutoff in CAA rules and the adequacy of technology-based standards to control VOCs from spent caustics that are discharged to wastewater treatment systems.

See comments in Section IV.E.2 of this response to comment document regarding the appropriateness of EPA's choice of management scenarios.

## **F. OFF-SPECIFICATION PRODUCT AND FINES FROM THERMAL PROCESSES**

### **1. Comment Supporting No-List Decision**

**Comment 1:** The commenter agrees with the EPA that under certain management practices (i.e., collection and combination with product), this residual is not a waste and not within the jurisdiction of the rulemaking. (Sun, 00034)

**Response:** The Agency acknowledges the commenter's support.

**Comment 2:** The commenter agrees that management practices where this residual becomes a waste (e.g., sent to the wastewater treatment plant, landfilled) do not pose unacceptable risk. (Sun, 00034)

**Response:** The Agency acknowledges the commenter's support.

### **2. Comments Against No-List Decision**

**Comment 1:** EPA failed to evaluate the risks posed by the most prevalent waste management practice - placement on a waste pile. The risks posed by this practice appear extremely high, based upon the related assessment of uncovered landfilling EPA conducted.

Off-spec product and fines from thermal processes are "most often" stored in onsite waste piles prior to reuse onsite or shipment offsite. Huge quantities of the waste may be managed in this manner; the high-end volume value for offsite transfer is 17,000 MT/yr per facility. Nationally, as much as 178,000 MT may have been stored in waste piles during 1992, or up to 91% of the waste generated that year.<sup>173</sup>

Despite the huge waste volumes involved, EPA chose not to model waste pile management because the piles may also include product coke, and "are thus not within the jurisdiction of this rulemaking."<sup>174</sup> On what legal or policy basis the fines on the waste pile are beyond the jurisdiction of this rulemaking, EPA never clearly explains.<sup>175</sup>

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<sup>173</sup>1995 Listing Background Document at pp. 142-143.

<sup>174</sup>60 FR 57771 (November 20, 1995).

<sup>175</sup>Later in the preamble discussion, EPA cryptically refers to Section 3004(q)(2)(A) of RCRA. This section exempts refinery wastes converted to petroleum coke onsite from certain standards governing fuel blending, burning for energy recovery, and associated labeling and record keeping. By its own terms, the exemption does not apply to the listing of hazardous wastes under Section 3001 of RCRA, the storage of the wastes prior to reuse as a fuel, wastes converted to petroleum coke offsite, or the placement of the wastes on land disposal units as that



The waste does not become a product simply because it is placed on the pile and combined with another material. If it did, any waste generator could avoid RCRA requirements by simply combining its wastes with other materials in a manner potentially posing greater risks. Moreover, pursuant to Section 3004(k) of RCRA, the waste pile is properly considered land disposal or land placement, thus the off-spec product and fines placed on the pile would not qualify for an exemption from RCRA requirements based on the prospect of subsequent reuse of the waste.<sup>176</sup>

As EPA noted in the proposal, the Agency did assess the potential risks from air releases associated with landfilling off-spec products and fines. What the Agency failed to mention is the assessment demonstrated the fines pose very high risks when placed on the piles.

In the analysis most relevant to waste pile management (where no daily cover is assumed), the cancer risks from onsite units exceeded  $1 \times 10^{-3}$  for home gardeners, subsistence farmers and subsistence fishers; and a high noncancer risk to subsistence fishers from mercury exposure was also predicted.<sup>177</sup> These risk estimates were derived using volumes less than one-seventh of the high-end volumes appropriate for waste pile storage. Therefore, based upon EPA's own abbreviated risk assessment for off-spec product and fines, waste pile management of this waste poses substantial risks that cannot and should not be ignored. (EDF, 00036)

**Response:** This comment reflects an area of confusion which EPA addressed in the 1997 NODA. In addition to the response below, see 67 FR 16750, *Jurisdictional Explanation of Off-Specification Product and Fines from Thermal Processes Used As Products*, and the NODA Response to Comments Document (Section I.A.5, Comment 4 and Section II.B). In general, most of the residual described by the commenter in fact is product, and the piles described by the commenter are not waste piles, but in fact are product storage piles.

EPA must first clarify the definition of the residual evaluated as “off-specification product and fines from thermal processes.” This category is best understood by differentiating between “off-specification product” and “fines”, and by differentiating between *delayed* coking and *fluid* coking operations. As described in the 1995 Listing Background Document for the 1992-1996 Petroleum Refining Listing Determination, “off-specification product” is primarily generated from *fluid* coking operations, used at only 7 refineries and accounting for 12,277 MT (6% of total) of the overall residual generated in 1992. The 1995 Listing Background Document for the 1992-

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term is defined in Section 3004(k) of RCRA.

<sup>176</sup>See proposed 261.4(e)(12) at 60 FR 57796 (November 20, 1995).

<sup>177</sup>Assessment of Risks from the Management of Petroleum Refining Wastes: Background Document, prepared for EPA by RTI, October 1995, Appendix Q, Table 3a.

1996 Petroleum Refining Listing Determination describes “off-specification product” further<sup>178</sup>.

On the other hand, “fines from thermal processes” are generally associated with the *delayed* coking process, are rarely considered off-specification, and generally are only differentiated from product coke because of their particle size. The delayed coking process is by far the most common thermal process. In this process, residuum is heated to the point of cracking, 900 to 950°F, and is continuously fed to a coke drum at 20 to 60 psi in the delayed coking unit. The residuum cracks in the drum; the gaseous products exit the top of the drum and are recovered in the fractionation section. Coke, a product of the cracking process, slowly builds up in the drum.

After approximately 24 hours, the coke drum fills with coke and the feed is switched to a parallel coke drum. The first drum is cooled and the built-up coke is hydraulically drilled out onto a product storage pad and sold as a product.

When drilled out of the coke drum, the sizes of coke chunks range from 1 foot to one millimeter. The larger chunks are typically easily transferred (via clamshell dredge, backhoe, bulldozer or other heavy equipment) to a coke product storage area, such as a product storage pile. The smaller particles (i.e., fines) may become entrained in the coker unit drilling water and are separated from the water by gravity, screening, or other physical separation processes. Fines may also appear near conveyer equipment. Since they are inherently the same<sup>179</sup>, most refineries do not distinguish fines from other coke product if they collect all of the material in one storage area for sale. Most product, including fines, is sold as coke. Very little of the material taken from the drums, therefore, is actually disposed.

The apparent reason for the confusion in the original proposal, and the likely reason this comment was generated stems from discussions that occurred well before the proposed rule was published. In workgroup discussions with industry and API that were undertaken as part of the development of the §3007 survey to gather information to support the rule, EPA explained that the consent decree required the Agency to decide whether to list the category “off-specification product and fines from thermal processes”. Industry, however, claimed that they did not generate off-spec coke product or fines.<sup>180</sup> They stated that they were able to sell all of their coke product and fines and that none was disposed of. Without industry-wide confirmation of this broad assertion, however, EPA decided to ask each refinery to describe its coker and its handling practices for

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<sup>178</sup>1995 Listing Background Document for the 1992-1996 Petroleum Refining Listing Determination, page 138 (thermal processes) and page 141 (fines definition).

<sup>179</sup>EPA. Supplemental Background Document, Listing Support Analyses, Petroleum Refining Process Waste Listing Determination. “Comparison of Product Coke to Off-spec Product and Fines from Thermal Processes.” March 1997.

<sup>180</sup>Industry stated that there are various grades of coke which all could be sold at one grade or another and, therefore, off-spec product was not generated.

coke fines and any off-specification product, regardless of whether they considered these materials to be waste or product. The survey gave no direction or definition of “off-spec” or “fines” and, therefore, it was left to the respondents’ discretion, which varied greatly between refiners. EPA then hoped to determine, by reviewing the individual generation and final management practices, which of these residuals were to be considered “actual waste” versus “product.”

The predominant management method reported for this residual in the survey was storage in a pile prior to offsite sales. EPA agrees with industry that fines, co-managed with larger coke particles are product, not waste, when managed in this manner. EPA’s assertion in the proposal that most fines are beyond RCRA jurisdiction was based on the presumption that these fines are in fact coke product. Based on observations from engineering site visits and as reported in the RCRA §3007 survey, off-spec coke or coke fines is most often combined with other coke onsite in a product pile where it is stored prior to sales. Coke and coke fines are inherently the same, only the particle size distinguishes them. Therefore, the large volumes quoted by the commenter are inflated and not necessarily considered “waste.” EPA assessed risks only from waste management, not product storage.

In response to the commenter’s concerns regarding waste pile, the Agency reviewed the survey responses that indicated pile management of coke fines to determine whether the piles were coke product piles or waste piles. One refiner reported “storage in a pile” as their final management step. Upon further review of their §3007 survey<sup>181</sup>, it was determined that this pile was the product storage pile and no coke product had been sent to the coke marketer in 1992 so no final management was reported by this facility.

At 19 of the 53 refineries with coking capacity, some portion of their coke fines were not recoverable in 1992 and were reported to be land disposed in 1992. Table IV.F-1 describes the generation and management of these wastes at the 12 refineries that provided non-CBI characterizations of their coking process. Six facilities reported land disposing off-spec coke and fines generated from the drilling water collection system. Three facilities reported land disposing off-spec coke and fines generated during unit turnarounds. Two facilities reported disposing of coke which was spilled or from unit sweepings. One facility said it disposed of contaminated coke. None of the facilities provided additional information concerning why or how the coke became off-spec or contaminated or why some of the fines were sold as product and some were land disposed. None of the refineries reported using “waste piles” for management of their off-specification product or fines.

The Agency did model the disposal in offsite and onsite Subtitle D landfills scenarios where actual disposal, such as described in the previous paragraph, was reported. This modeling was described in the docket to the proposed rule. As part of this modeling, EPA assessed the potential for air

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<sup>181</sup> 1992 RCRA 3007 Survey for National Cooperative Refinery Association, McPherson, KS, Facility 058.

releases during landfilling as a result of the frequent generation frequency and small particle size associated with this residual and believed that this assessment may be comparable to the potential risks associated with on-site storage prior to final management. The high end and central tendency analyses conducted in support of the proposed rule showed no risk at levels of concern to the listing determination.<sup>182</sup>

The cancer risks EDF quotes as being “most relevant to waste pile management” are from a bounding analysis of landfills. The goal of a bounding analysis is to “postulate a set of values for the parameters in the exposure or dose equation that will result in an exposure or dose higher than any exposure or dose expected to occur in the actual population.” Bounding estimates are used as an initial screening estimate that overestimates the exposure or dose in an actual population for the purpose of developing a risk estimate that is ‘not greater than’ (See 1995 Assessment of Risks from the Management of Petroleum Refining Waste: Background Document <sup>183</sup>). The purpose of the bounding analysis is simply to determine what pathways and scenarios require further evaluation and does not represent an assessment of risks.

In the bounding analysis for landfilling, the Agency did incorporate an assumption of no daily cover, which might apply to an assessment of waste pile storage, as well as other conservative assumptions. While this worst case screening analysis showed risk, the subsequent high end analyses supporting the proposed rule did not show risk within the preemptive listing range. This bounding analysis showed risk, and therefore a high end analysis was conducted; assumptions used in this high end analysis included the following: (1) daily cover, (2) windblown dust from road, loading, unloading, and dump trucks. Therefore, the high end analysis did not consider windblown dust from the landfill but did consider windblown dust from other sources. The high end analysis showed risks no higher than  $2 \times 10^{-6}$  for any receptor (U.S. EPA, Assessment of Risks from the Management of Petroleum Refining Wastes Background Document (F-95-PRLP-S0006), page 10-3).

The risk assessment for off-specification product and fines from thermal processes was discussed further in the April 8, 1997 NODA (62 FR 16751). Additional public comments were submitted regarding the NODA and the Agency’s response to these comments can be found in the NODA Response to Comments Document.

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<sup>182</sup>Note that additional modeling was noticed in the 1997 NODA, and in support of the final rule, as discussed further in the NODA Response to Comment Document, in the final rule, and in the final risk assessment background documents (Uncertainty Analysis: NonGroundwater Pathway Risk Assessment, 1998, and Additional Groundwater Pathway Analyses, 1998).

<sup>183</sup>The commenter referred to high noncancer risks for mercury in the 1995 background document. (EPA. Assessment of Risks from the Management of Petroleum Refining Wastes: Background Document. October 1995. Appendix Q.) These results were erroneously included in the report, reflecting an incorrect modeling run that used inappropriate partitioning constants. The corrected runs show no risk for mercury in the bounding and high end analyses.

**Table IV.F-1. Non-CBI Description of Off-specification Coke and Fines Generation for Land Disposed Residuals**

<b>Facility</b>	<b>Off-spec Coke and Fines Description</b>	<b>Volume (MT)</b>	<b>Land Management</b>
Shell, Martinez, CA	Coke contaminated with inerts (i.e., dirt)	4.5	Offsite Subtitle C landfill
Farmland, Coffeyville, KS	Drilling water fines are sent with product coke or landfilled. Presently, fines are sent to a cement kiln burning hazardous fuels	164	Onsite Subtitle D landfill
Texaco, El Dorado, KS	Coker fractionator bottoms	2.8	Onsite Subtitle D landfill
Citgo, Lake Charles, LA	Drilling water fines are accumulated and sent offsite for disposal	218	Offsite Subtitle D landfill
Conoco, Westlake, LA	Off-spec coke from delayed coker and spilled coke from calciner	535	Offsite Subtitle D landfill
Conoco, Billings, MT	Drilling water coke fines not meeting specs	9.5	Offsite Subtitle C landfill
Coastal, Corpus Christi, TX	Visbreaker coke fines from soaking drum turnaround were reported to have no value	10	Offsite Subtitle D landfill
Hess, St. Croix, VI	Coke from Visbreaker fractionator tower turnaround	20	Onsite Subtitle D landfill
Chevron, Salt Lake City, UT	Fines from decoking water maze	21.2	Offsite land treatment unit
Texaco, Anacortes, WA	Coke fines from drilling water	Not Available	Onsite land treatment unit
ARCO, Ferndale, WA	Coke fines from drilling water maze or contaminated with inerts	1	Onsite land treatment unit
Texaco (Area 3), Bakersfield, CA	Coke fines collected from sweeping around coker area	36	Offsite Subtitle C landfill
Exxon, Benicia, CA	CBI	639	Offsite Subtitle C landfill
Unocal, Wilmington, CA	CBI	19.9	CBI
Exxon, Billings, MT	CBI	90.7	Offsite Subtitle D landfill
BP, Lima, OH	CBI	5757	Offsite Subtitle D landfill

Facility	Off-spec Coke and Fines Description	Volume (MT)	Land Management
Sun, Tulsa, OK	CBI	34	Onsite land treatment unit
Exxon, Baytown, TX	CBI	518	Offsite Subtitle C and Offsite Subtitle D landfill
Lyondell-Citgo, Houston, TX	CBI	12	Offsite Subtitle D landfill

**Comment 2:** EPA's landfill modeling suffers from a series of methodology flaws and assumptions that have the effect of vastly understating the risks posed by off-spec product and fines from thermal processes. The specific areas of concern to the commenter are enumerated in Comments 3 through 10 below. Correcting these deficiencies in the landfill modeling would raise the risk levels to the point where listing the waste would be warranted. (EDF, 00036)

**Response:** EPA's specific responses to each of the points raised by the commenter are provided in the responses to Comments 3 through 10 below. EPA's conclusion regarding off-specification product and fines is unchanged as a result of these modifications.

**Comment 3:** EPA used TCLP results as the input values to the landfill groundwater modeling despite the acknowledged ineffectiveness of the procedure for oily wastes. (EDF, 00036)

**Response:** As discussed in detail in Section III.H, EPA remains convinced that it is appropriate to use the TCLP to characterize these residuals and to use TCLP results as input to the groundwater model. The total oil and grease results (presented in Table 1 of the Supplemental Background Document for Listing Support Analyses, 1997) indicate that off-specification product and fines are generally not oily. The Agency was able to conduct total oil and grease analyses on 4 of the 6 collected samples (insufficient sample remained of the other two archived samples). One sample had undetectable levels of oil and grease, and two others had levels less than 1 percent (0.6 and 0.03 percent). While the fourth sample had levels of 8.4 percent oil and grease, this sample was dredged from the coke pit and therefore was not dry. If this residual had been destined for landfilling, the coker water would have most likely drained from the fines on the coke pad. It is likely that the oil and grease content of the waste upon drying would have been much more in line with the other three coke fines samples assessed by EPA for oil and grease content. Regardless of the ultimate oil content of this waste, benzene was not detected in either the total or the TCLP analyses of this sample and no difficulties were noted by the laboratory conducting the TCLP analyses. Further, as noted elsewhere, the total oil and grease method is *not* a valid measure of "free" oil, and none of EPA's samples exhibited such multi-phase behavior.

**Comment 4:** EPA failed to account for the effects of co-disposal with other refinery and

industrial wastes in its modeling. (EDF, 00036)

**Response:** EPA did evaluate the potential effects of co-disposal of off-spec product and fines from thermal processes with other refinery residuals, as described in Section III.I, Comment 3 and in the April 8, 1997 NODA. The ground-water analysis was revised based on comments to the NODA, and the final revised analysis showed that the maximum groundwater high end risk for this residual alone (without co-disposal) was  $2 \times 10^{-6}$ , while the comparable risk for the co-disposal scenario modeling off-site landfills showed benzene-associated risks of  $8 \times 10^{-6}$  and  $3 \times 10^{-6}$  for co-disposal with and without hydrocracking catalysts, respectively<sup>184</sup>, (somewhat lower risks were found for arsenic in the codisposal analysis)<sup>223</sup> Similarly, for the non-groundwater risk analysis, the maximum high end risk for this residual alone (without co-disposal) was  $9 \times 10^{-8}$  (off-site) and  $7 \times 10^{-8}$  (on-site)<sup>185</sup>, while the comparable risks for the co-disposal scenario modeling on-site land treatment units for the subsistence farmer scenario showed risk of  $5 \times 10^{-7}$ .<sup>186</sup> EPA does not believe that consideration of potential co-disposal risks in any way supports listing this residual as hazardous.

**Comment 5:** EPA failed to account for the free-phase flow of contaminants. (EDF, 00036)

**Response:** EPA concluded that free phase flow is unlikely with these residuals as discussed in Section III.H with respect to the appropriateness of the TCLP and Section III.K with respect to the Agency's modeling of potential free-phase flow. It is particularly important to note that none of the six off-spec product and fines from thermal processes samples exhibited multi-phase behavior.

**Comment 6:** EPA inappropriately assumed for its evaluation of dissolved phase groundwater contaminants a small onsite and offsite landfill waste unit area size. (EDF, 00036)

**Response:** As further discussed in Section III.J, the groundwater risk assessment modeling has been adjusted to improve its consideration of off-site landfill area.

**Comment 7:** EPA improperly assumed a short active life for all landfills. (EDF, 00036)

**Response:** As discussed further in Section III.L, EPA adjusted the landfill active life assumptions.

**Comment 8:** EPA failed to consider risks to subsistence farmers and fishers. (EDF, 00036)

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<sup>184</sup>U.S. EPA. Additional Groundwater Pathway Analyses. 1998.

<sup>185</sup>See Table III of the April 8, 1997 NODA.

<sup>186</sup>See Table 15.2 of the "Supplemental Background Document; NonGroundwater Pathway Risk Assessment; Petroleum Process Waste Listing Determination," March 20, 1997.

**Response:** Subsistence fishers and farmers were not addressed definitively in the proposed rule because of the substantial uncertainties associated with the biotransfer factors for PAHs. EPA has since attempted to address uncertainties associated with bioaccumulation of PAHs in fish and mammals. A detailed discussion of this effort are provided in Section III.M and the Uncertainty Analysis: NonGroundwater Pathway Risk Assessment, 1998.

**Comment 9:** EPA failed to consider risks from dermal and inhalation exposure to groundwater contaminants such as benzene. (EDF, 00036)

**Response:** Benzene was not detected in the leachate of the Agency's samples, thus this issue is not relevant to risks for this waste.

**Comment 10:** EPA failed to sum risks across groundwater and non-groundwater pathways. (EDF, 00036)

**Response:** See Section III.R for the Agency's response to this issue.

**Comment 11:** The average total concentration of chrysene and benzo(a)pyrene in off-spec product and fines from thermal processes exceed the comparable concentrations in F038 and K145 that caused those wastes to be listed in 1990 and 1992. In the 1990 and 1992 rulemakings, the Agency properly considered the deficiencies in the TCLP, and the potential effects of co-disposal, in the listing determinations. (EDF, 00036)

**Response:** EPA recognizes that this and other residuals characterized in this listing determination contain concentrations of toxicants equal to or greater than previously listed wastes, including the F037 and F038 refinery residuals. Direct comparison of these concentrations to previous listing benchmarks is not an adequate basis for listing given the significant advances in the Agency's risk assessment expertise. See also EPA's response to Comment 14 in Section IV.A.5, above.

Thus, while the off-specification product and fines toxicant concentrations may be greater than corresponding concentrations in F038 sludges, EPA has applied its current (and more precise) risk assessment methodology, carefully considering the likely waste management practices for this residual, among other factors, and determined that the data supports a no list finding.

### 3. Definition of Solid Waste

**Comment 1:** The Agency implies that its decision not to list this residual stems from an analysis that indicates that the risks to human health and the environment are insufficient to warrant listing. However, the Agency also acknowledges that most of the coke fines are sold with product coke which is statutorily exempt (unless it exhibits a hazardous characteristic). In the commenter's view, the latter fact is and has been controlling and defines this residual as a product, and clearly not a solid waste. Hence, it should be excluded from the definition of a solid waste with no relative risk assessment required or have bearing on the listing determination. Since the residual is



a product and not a solid waste, it cannot be a hazardous waste by definition. (Mobil, 00033)

**Response:** EPA's position regarding the definition of solid waste and this residual is discussed in the April 8, 1997 NODA and Section II.B of the NODA Response to Comments Document.

## **G. CATALYST AND FINES FROM CATALYTIC CRACKING**

### **1. Comments Supporting No-List Decision**

**Comment 1:** The commenter agrees with the EPA that partially deactivated Fluid Catalyst Cracking (FCC) catalyst used in another FCC unit is not a solid waste and should not be evaluated for listing. (Sun, 00034)

**Response:** EPA acknowledges the commenter's input.

**Comment 2:** The commenter believes that the use of FCC catalyst as an ingredient in cement is an activity in which the residual is not a solid waste. (Sun, 00034)

**Response:** Readers are referred to the proposal for EPA's position on this issue (60 FR 57772).

**Comment 3:** The commenter agrees with EPA that all management practices evaluated by EPA do not pose risks that require a hazardous waste listing for this residual. (Sun, 00034)

**Response:** EPA acknowledges the commenter's support.

**Comment 4:** The commenter supports EPA's decision not to list catalyst and catalyst fines from the FCC unit. (Amerada Hess, 00027; Systech, 00011)

**Response:** EPA acknowledges the commenters' support.

**Comment 5:** There is adequate protection from potentially hazardous wastes due to the hazardous characteristic rules. (Amerada Hess, 00027)

**Response:** In the case of this residual, EPA's data show that less than 3 percent of the volume of this material is managed as hazardous. However, as noted in the proposed rule, EPA found no significant risks for this waste.

**Comment 6:** Spent FCC catalyst is an acceptable raw material substitute in the cement manufacturing process. To list these materials as hazardous would impose an unnecessary barrier to their reuse in other processes yet offer little additional protection to human health and the environment. This would be counterproductive to the purposes of RCRA. (Systech, 00011)

**Response:** EPA has determined through the risk assessment process that there is no basis for listing this residual as hazardous.

## H. SLUDGE FROM HF ALKYLATION

### 1. Comments Supporting No-List Decision

**Comment 1:** The commenter agrees with the EPA that the risks posed by the management practices for this residual do not justify listing. (Sun, 00034)

**Response:** The EPA acknowledges the commenter's support.

**Comment 2:** The commenter agrees with EPA that the risks, if any, posed by minor management methods used by some refineries do not need to be evaluated. (Sun, 00034)

**Response:** The EPA acknowledges the commenter's support.

### 2. Comments Against No-List Decision

**Comment 1:** EPA failed to evaluate the risks posed by managing this waste in surface impoundments, even though the wastes are frequently generated in the impoundments, the practice was used in 1992, and there is no technical or legal bar for a refinery to utilize readily available existing impoundments for this purpose . . .

Even though HF alkylation sludge is frequently generated in "neutralization pits," EPA's waste samples were collected from the pits where they were generated, and the Agency documented subsequent management in a surface impoundment, EPA did not evaluate the risks posed by managing HF alkylation sludge in surface impoundments.<sup>187</sup> EPA's rationale for not conducting the evaluation was the "rare" nature of the subsequent management practice, based upon the one facility reporting that practice in 1992.<sup>188</sup>

EPA's rationale completely ignores the risks posed by the sludge at its point of generation, where HF alkylation sludge in surface impoundments is more the rule than the exception. Furthermore, the 1992 data covered only 26 waste streams from a potentially smaller number of refineries, while 59 refineries are reported to use HF alkylation units.<sup>189</sup> Therefore, EPA cannot determine how "rare" impoundment management is based only upon 1992 reporting data.

Perhaps most important, EPA offers no legal or other barrier to surface impoundment management of HF alkylation sludge. There are certainly an ample number of existing surface impoundments at petroleum refineries that could be used in this manner. And as EPA stated in

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<sup>187</sup>1995 Listing Background Document at 128-129, 135.

<sup>188</sup>1995 Listing Background Document at 132.

<sup>189</sup>1995 Listing Background Document at 128, 131.

describing its listing determination policy, management scenarios “need not be in use currently to be considered plausible by EPA since disposal practices can and do change over time. Potential future waste management practices are projected and considered in the risk analysis, if appropriate.”<sup>190</sup> (EDF, 00036)

**Response:** The commenter is mistaken in interpreting EPA's nomenclature. From its site visits, EPA found that HF alkylation sludge is commonly generated in concrete lined in-ground pits or tanks located within the HF process unit boundary. To substantiate EPA's conclusion that HF alkylation sludge is not generated in surface impoundments, EPA reviewed its site visit reports and RCRA §3007 questionnaire responses from all 59 facilities with HF alkylation units. This review confirmed EPA's original findings: EPA found only one instance where HF alkylation wastes are presently (as of November, 1996) managed in clay-lined ponds (and potentially generate HF alkylation sludge), and two instances where the practice was discontinued. The one refinery that reported still using an impoundment when contacted in November, 1996 (Chevron's Salt Lake City, Utah refinery) reported a quantity of only 2.3 MT generated in 1992. The refineries that discontinued use of impoundments reported that the 1992 quantities were 221 MT, and 21.4 MT. These quantities are small compared with 50th percentile (1,448 MT) and 90th percentile (2,257 MT) quantities modeled in the landfill scenario. Therefore, EPA disagrees with the commenter that HF sludge is commonly generated in surface impoundments and maintains its belief that management of HF alkylation sludge in a surface impoundment is indeed a “rare” occurrence.

EPA disagrees with the commenter that surface impoundment disposal is a realistic scenario. The one case of actual management of this waste in a surface impoundment in 1992 was reported to be discontinued that year (see page 131 of Listing Background Document for the 1992-1996 Petroleum Refining Listing Determination). EPA continues to maintain that its 1992 data is representative of disposal practices and that to incorporate increased reliance of surface impoundments is not plausible, particularly in light of EPA's knowledge that such practices are being discontinued and the costs associated with construction and permitting. Further, the commenter suggests that refineries have many unused surface impoundments that in the future could be used for HF alkylation waste management. The Agency finds this to be an unfounded assertion, and, based on the Agency's understanding of refinery operations, a highly unlikely scenario. First, HF alkylation pits are often located within the unit boundary of the HF alkylation process. Due to the risks associated with hydrogen fluoride and the extensive training required for any refinery personnel working on this process, it is unlikely that refineries would locate these pits at any distance from the alkylation unit. Second, surface impoundments are generally associated with refinery wastewater treatment systems, which are not likely to be located within close proximity to the HF alkylation unit. The Agency believes that the scenario described by the commenter is implausible.

EPA observed during its site visits that the concrete HF pits were used to prevent fluorides and

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<sup>190</sup>59 FR 66074 (December 22, 1994) (emphasis added).

low pH wastes from being discharged to the wastewater treatment facilities in large quantities. Fluorides were described by several refineries during these site visits to create effluent compliance problems. Thus, removal in the HF pits associated with the units makes sense from a processing perspective. In addition, several refineries described changes that they had made or were contemplating regarding their methods of HF acid neutralization. Certain methodologies result in a higher purity fluoride salt which is amenable to off-site sales as a fluoride raw material. These process considerations also contribute to the unlikelihood that refineries would increase their use of impoundments for HF process waste neutralization.

Finally, EPA notes that the only constituent of concern found in HF-alkylation sludge was benzene, and this was only found in one out of the five TCLP samples of this waste. Thus, it is not frequently present in this wastes. Furthermore, the landfill dilution and attenuation factor (DAF) calculated from the ratio of TCLP input to the well concentration for the high-end risk ( $1\text{E-}5$ ) was 2.8. Even if the same maximum TCLP input was used, and there was *no* dilution or attenuation of benzene released from a surface impoundment, the worst case risk could not exceed  $2.8\text{E-}5$ . Given the rarity of this practice, the infrequent detection of TCLP benzene in the waste, the relatively small volumes reported to still go to impoundments (2.3 MT), and the likelihood that some dilution and attenuation would occur for any release, EPA does not believe management in a surface impoundment is likely to present risks of concern.

**Comment 2:** Even though EPA's modeling systematically understates risks through a series of methodology flaws and incorrect assumptions, groundwater ingestion risks of  $3\text{x}10^{-6}$  were identified. The commenter listed nine areas where he believed the risk assessment was inadequate, as detailed below in Comments 3 through 11 of this section.

**Response:** EPA addressed a number of the commenters' concerns on the proposed rule in the April 8, 1997 NODA, and addressed additional comments submitted on the NODA analysis. The final risk assessment results show a maximum risk of  $1\text{x}10^{-5}$  for off-site landfilling (high end groundwater analysis). In addition, the Monte Carlo analysis for off-site landfills showed a relatively low risk of  $2\text{E-}06$ . As noted above, benzene was found only in one out of five TCLP samples. Furthermore, this waste typically does not have high PAH or oil content, nor does HF alkylation have the oil and benzene content of crude oil tank sediment. Therefore, the Agency is finalizing a decision not to list this wastestream. EPA's responses to the specific areas of concern raised by the commenter are presented below in Comments 3 through 11 of this section.

**Comment 3:** EPA used TCLP results as the input values to the landfill groundwater modeling despite the acknowledged ineffectiveness of the procedure for oily wastes. (EDF, 00036)

**Response:** As discussed in detail in Section III.H of this response to comment document, EPA remains convinced that it is appropriate to use the TCLP to characterize these residuals and to use TCLP results as input to the groundwater risk assessment.

**Comment 4:** EPA failed to account for the effects of co-disposal with other refinery and

industrial wastes, and used improperly low volume assumptions, in its modeling. (EDF, 00036)

**Response:** EPA did evaluate the potential effects of co-disposal of process sludge from HF alkylation with other refinery residuals, as described in Section III.I, Comment 3 of this response to comment document. The results of this analysis are presented in the final rule and showed that the maximum groundwater high end risk for this residual alone (without co-disposal) was  $1 \times 10^{-5}$ , while the comparable risk for the co-disposal scenario modeling off-site landfills showed lower benzene-associated risks of  $8.9 \times 10^{-6}$  and  $3.8 \times 10^{-6}$  for co-disposal with and without hydrocracking catalysts, respectively<sup>191</sup>. For the non-groundwater risk analysis, the Agency's data base did not reveal any cases where HF alkylation sludge was co-disposed with other refinery residuals<sup>192</sup>. EPA does not believe that consideration of potential co-disposal risks support listing this residual as hazardous.

**Comment 5:** EPA failed to account for the free-phase flow of contaminants. (EDF, 00036)

**Response:** EPA concluded that free phase flow is unlikely with these residuals as discussed in Section III.H of this response to comment document with respect to the appropriateness of the TCLP and Section III.K with respect to the Agency's modeling of potential NAPL formation. None of the five HF sludge samples were found to exhibit multi phase behavior (see Table 1 of Supplemental Background Document for Listing Support Analyses, 1997 ).

**Comment 6:** EPA improperly assumed land treatment units managing this waste would always be equipped with run-off controls operating at 50% efficiency. (EDF, 00036)

**Response:** This issue is discussed further in Section III.G of this response to comment document. EPA would like to note that nongroundwater risks are unlikely to be significant for this waste because HF alkylation sludge has none of the carcinogenic PAHs that were of concern for other wastes. For example, while CSO sediment samples had an average of 132 ppm of the PAH benzo(a)pyrene, none was detected in any sample of HF alkylation sludge.

**Comment 7:** EPA inappropriately assumed for its evaluation of dissolved phase groundwater contaminants a small waste unit area size for onsite land treatment facilities, and for onsite and offsite landfills. (EDF, 00036)

**Response:** As further discussed in Section III.J of this response to comment document, the groundwater risk assessment modeling has been adjusted to improve its consideration of off-site landfill area.

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<sup>191</sup>See Table 5.7 of the "Additional Groundwater Pathway Analyses; Supplemental Background Document", 1998.

<sup>192</sup>See Table III of the April 8, 1997 NODA.

**Comment 8:** EPA improperly assumed a short active life for all landfills. (EDF, 00036)

**Response:** As discussed in Section III.L of this response to comment document, EPA adjusted the landfill active life assumptions,

**Comment 9:** EPA failed to consider risks to subsistence farmers and fishers. (EDF, 00036)

**Response:** Subsistence fishers and farmers were not addressed definitively in the proposed rule because of the substantial uncertainties associated with the biotransfer factors for PAHs. EPA has since attempted to address uncertainties associated with bioaccumulation of PAHs in fish and mammals. A detailed discussion of this effort are provided in Section III.M of this response to comment document and the Uncertainty Analysis: NonGroundwater Pathway Risk Assessment (1998). However, as noted above, none of the carcinogenic PAHs were detected in EPA's samples of HF alkylation sludge

**Comment 10:** EPA failed to consider risks from dermal and inhalation exposure to groundwater contaminants such as benzene. (EDF,00036)

**Response:** This issue was discussed in Section III.O of this response to comment document.

**Comment 11:** EPA failed to sum risks across groundwater and non-groundwater pathways. (EDF, 00036)

**Response:** As discussed in detail in Section III.R of this document, the Agency's examination of the data did not support incorporation of this comment for this or any other residual of concern to this rulemaking.

**Comment 12 :** Just accounting for improper use of the TCLP results, and including the dermal and inhalation effects of contaminant exposure, would raise the landfilling risk levels to those warranting listing. When all the flaws in the risk assessment methodology are addressed, and EPA truly characterizes the risks posed by HF alkylation sludge, the risk levels would vastly exceed presumptive listing levels. (EDF, 00036)

**Response:** After reviewing all of the public comments, the risk assessment was modified to address those comments which the Agency agreed had merit and could be addressed by currently available risk assessment tools. These revisions are described in the April 8, 1997 NODA and today's docket. The re-analysis showed that the ground-water risk increased slightly to  $1 \times 10^{-5}$  and the non-groundwater risk does not exceed  $4 \times 10^{-8}$ . EPA decided not to list this waste based on the relatively low groundwater risks found ( $1 \times 10^{-5}$ ) due solely to benzene, and the fact that benzene not frequently found in the TCLP analysis (one of five samples). Furthermore, this waste typically does not have high PAH or oil content, as does the CSO tank sediment, nor does HF alkylation have the oil and benzene content of crude oil tank sediment. These results confirm the Agency's proposal that HF alkylation sludge not be listed as hazardous.

**Comment 13:** Even at risk levels within the  $10^{-4}$  to  $10^{-6}$  risk range, HF alkylation sludge warrants listing as a hazardous waste based upon the factors EPA considers under its listing determination policy when risks from improper waste management fall in that range. First, the waste characterization is extremely uncertain since it substantially understates the risks posed by HF alkylation sludge insofar as TCLP results are used. Second, the risk assessment is also extremely uncertain because it vastly underestimates potential risks due to unsupported assumptions regarding management practices and the failure to consider important exposure pathways and population receptors. Third, EPA completely failed to consider co-occurrence or co-disposal with other wastes, and the resulting aggregation of constituents and potential for free phase flow. Fourth, other regulatory programs will not address the risks posed by the mismanagement of these wastes. (EDF, 00036)

**Response:** The EPA has considered each of the commenter's four arguments claiming that EPA's risk assessment and decision making understates the potential hazards associated with HF alkylation sludge. The Agency's specific responses are provided below in comments 13a through 13d. After evaluating each of these factors, as well as the other factors listed in EPA's listing determination policy, EPA has concluded that the weight of evidence for HF alkylation sludge demonstrates that this residual does not merit listing as a hazardous waste.

**Comment 13a:** The waste characterization is extremely uncertain since it substantially understates the risks posed by HF alkylation sludge insofar as TCLP results are used. (EDF, 00036)

**Response:** As discussed in Section III.H of this response to comment document and in Comment 3 above in this section, EPA asserts that it was appropriate to use the TCLP results as input to the ground-water model.

**Comment 13b:** The risk assessment is extremely uncertain because it vastly underestimates potential risks due to unsupported assumptions regarding management practices and the failure to consider important exposure pathways and population receptors. (EDF, 00036)

**Response:** As described above (see response to Comment 1 in Section IV.H.2 of this response to comment document) EPA disagrees that there is a need to model surface impoundments as a scenario of concern for this residual. Other risk assessment assumptions of concern to the commenter are addressed in response to Comment 2 above in this section. The Agency agrees that there is uncertainty associated with the results of the risk assessment. EPA completed a Monte Carlo analyses of the groundwater pathway and the results suggest that the risks for this waste are not significant. Specifically, the revised groundwater results for offsite landfills showed a 95th percentile risk of  $2E-6$  for this waste, well below EPA's level of concern. An uncertainty and variability analysis has also been performed in support of the nongroundwater risk assessment for this rule. A detailed discussion of the qualitative and quantitative aspects of this analysis are presented in the Uncertainty Analysis: NonGroundwater Pathway Risk Assessment (1998). EPA has concluded that the risk assessment provides a reasonable measure of risk and that uncertainty levels are acceptable.



The Agency notes that uncertainties are inherent in any type of risk assessment or modeling and EPA continually reviews its risk assessment methodologies to determine whether or not the levels of uncertainty are acceptable to support its decision making process. The commenter's specific concerns with EPA's assumptions regarding management practices and populations receptors are addressed under more specific comments throughout this document.

**Comment 13c:** EPA completely failed to consider co-occurrence or co-disposal with other wastes, and the resulting aggregation of constituents and potential for free phase flow. (EDF, 00036)

**Response:** As described in the April NODA (see also comment 3 in Section III.I of this response to comment document), EPA has conducted a co-disposal analysis and continues to find that the risks associated with this residual do not warrant listing.

**Comment 13d:** Other regulatory programs will not address the risks posed by the mismanagement of these wastes. (EDF, 00036)

**Response:** EPA does not believe the potential risks for this waste merit listing. Concerning other regulatory programs, EPA continues to believe that the primary source of risk associated with this waste is benzene and refineries are subject to extensive benzene controls already through the Benzene NESHAPs and the toxicity characteristic for benzene. Thus, these other regulations will, in fact, provide additional controls for any potential benzene risks.

#### **I. SLUDGE FROM SULFUR COMPLEX AND H<sub>2</sub>S REMOVAL FACILITIES**

**Comment 1:** The commenter agrees with the EPA that this waste should not be listed based upon the minor risks posed by the management practices for this residual. The Agency correctly identified the management methods used for these residuals and then correctly concluded that no significant risks are posed by these management methods. (Sun, 00034)

**Response:** EPA acknowledges the commenter's support.

#### **J. CATALYST FROM SULFUR COMPLEX AND H<sub>2</sub>S REMOVAL FACILITIES**

**Comment 1:** The commenter agrees with the EPA that the risks posed by the plausible management practices for these residuals do not justify listing the residuals as hazardous waste. (Sun, 00034)

**Response:** EPA acknowledges the commenter's support.

#### **K. UNLEADED GASOLINE TANK SEDIMENT**

##### **1. Comments Supporting No-List Decision**

**Comment 1:** The commenter agrees with EPA that this residual should not be listed as a hazardous waste. As the EPA correctly points out in the preamble discussion, the only potential contaminant of concern is benzene. Residuals with higher levels of benzene are likely to be managed as hazardous waste under the toxicity characteristic, thereby minimizing or eliminating the minor risks associated with disposal in a Subtitle D landfill. As a result, listing is unnecessary. (Sun, 00034)

**Response:** EPA acknowledges the commenter's support. While the toxicity characteristic does provide controls for those residuals which leach high levels of benzene, EPA's risk assessment generally did not show sufficient risk to support a positive listing determination. EPA continues to believe that the listing of this waste is not warranted, as noted in the response to the next comment.

## 2. Comments Against No-List Decision

**Comment 1:** EPA's no list rationale lacks merit. EPA's risk assessment methodology substantially underestimated the risks posed by the mismanagement of unleaded gasoline storage tank sludge. The specific areas of deficiency identified by the commenter are enumerated in Comments 2 through 11. (EDF, 00036)

**Response:** EPA disagrees with the commenter and believes, as further described in response to Comment 2 through 11 below and elsewhere in this document, that the no list rationale for unleaded gasoline storage tank sediment is defensible.

**Comment 2:** EPA failed to model the use of this waste as landfill cover. (EDF, 00036)

**Response:** No refineries reported use of unleaded gasoline tank sediment as landfill cover. The Agency has no data supporting this management scenario and therefore does not see the need to model this pathway.

**Comment 3:** EPA inappropriately used TCLP results as the input values to the landfill groundwater modeling despite the acknowledged ineffectiveness of the procedure for oily wastes. (EDF, 00036)

**Response:** As discussed in Section III.H of this response to comment document, EPA remains convinced that it is appropriate to use the TCLP results to characterize these residuals and to use TCLP results as input to the ground-water model. As shown in Table 1 of the Supplemental Background Document for Listing Support Analyses, Petroleum Refining Process Waste Listing Determination, 1997, oil and grease levels in 2 of the 3 samples were well below 1 percent (insufficient sample remained of the third sample for TOG analysis). These data support EPA's conclusion that the TCLP is an adequate measure of mobility.

**Comment 4:** EPA failed to account for the effects of co-disposal with other refinery and

industrial wastes, and used improperly low volume assumptions, in its modeling. (EDF, 00036)

**Response:** EPA did evaluate the potential effects of co-disposal of unleaded gasoline tank sediment with other refinery residuals, as described in Section III.I, Comment 3. The results of this analysis were presented in the April 8, 1997 NODA and showed that the maximum groundwater high end risk for this residual alone (without co-disposal) was  $3 \times 10^{-5}$ , while the comparable risk for the co-disposal scenario modeling off-site landfills showed lower benzene-associated risks of  $8.9 \times 10^{-6}$  and  $3.8 \times 10^{-6}$  for co-disposal with and without hydrocracking catalysts, respectively<sup>193</sup>. For the non-groundwater risk analysis, the Agency's data base did not reveal any cases where unleaded gasoline tank sediment was co-disposed with other refinery residuals<sup>194</sup>. EPA does not believe that consideration of potential co-disposal risks support listing this residual as hazardous.

**Comment 5:** EPA failed to account for the free-phase flow of contaminants. (EDF, 00036)

**Response:** EPA concluded that free phase flow is unlikely with these residuals as discussed in Section III.H with respect to the appropriateness of the TCLP and Section III.K with respect to the Agency's modeling of potential NAPL formation. It is particularly important to note that the levels of oil and grease in the samples analyzed were quite low (less than 1 percent), and that none of the three unleaded gasoline tank sediment samples exhibited multi-phase behavior.

**Comment 6:** EPA improperly assumed land treatment units managing this waste would always be equipped with run-off controls operating at 50% efficiency. (EDF, 00036)

**Response:** As discussed further in Section III.G of this response to comment document, EPA conservatively assumed that no runoff controls were present in its high-end analysis of risk to individuals residing near land treatment facilities managing petroleum waste streams because the presence and effectiveness of such controls could not be verified. EPA would like to note that nongroundwater risks are unlikely to be significant for this waste because unleaded gasoline tank sediment has none of the carcinogenic PAHs that were of concern for other wastes. For example, while CSO sediment samples had an average of 132 ppm of the PAH benzo(a)pyrene, none was detected in any sample of unleaded sediment.

**Comment 7:** EPA inappropriately assumed for its evaluation of dissolved phase groundwater contaminants a small waste unit area size for onsite land treatment facilities, and for onsite and offsite landfills. (EDF, 00036)

**Response:** As further discussed in Section III.J of this response to comment document, the

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<sup>193</sup>U.S. EPA. Additional Groundwater Pathway Analyses Supplemental Background Document; Petroleum Refining Process Waste Listing Determination. 1998.

<sup>194</sup>See Table III of the April 8, 1997 NODA.

groundwater risk assessment modeling has been adjusted to improve its consideration of off-site landfill area.

**Comment 8:** EPA improperly assumed a short active life for all landfills. (EDF, 00036)

**Response:** As discussed further in Section III.L of this response to comment document, EPA adjusted the landfill active life assumptions.

**Comment 9:** EPA failed to consider risks to subsistence farmers and fishers. (EDF, 00036)

**Response:** Subsistence fishers and farmers were not addressed definitively in the proposed rule because of the substantial uncertainties associated with the biotransfer factors for PAHs. EPA has since attempted to address uncertainties associated with bioaccumulation of PAHs in fish and mammals. A detailed discussion of this effort are provided in Section III.M of this response to comment document and the Uncertainty Analysis: NonGroundwater Pathway Risk Assessment (1998). As noted above, none of the carcinogenic PAHs were found in the waste, so this issue is not relevant to this waste.

**Comment 10:** EPA failed to consider risks from dermal and inhalation exposure to groundwater contaminants such as benzene. (EDF, 00036)

**Response:** See Section III.O of this response to comment document for a full response to this general comment.

**Comment 11:** EPA failed to sum risks across groundwater and non-groundwater pathways. (EDF, 00036)

**Response:** See Section III.R of this response to comment document for an explanation of why the risk assessment was not modified to address this concern.

**Comment 12:** With all its flaws, EPA's risk assessment still indicated the waste poses a cancer of risk of  $2 \times 10^{-6}$  from the ingestion of contaminated groundwater. Just accounting for improper use of the TCLP results, and including the dermal and inhalation effects of contaminant exposure, would raise the risk levels to those warranting a presumptive listing. When all the flaws in the risk assessment methodology are addressed, and EPA truly characterizes the risks posed by unleaded gasoline storage tank sludge, the risk levels would vastly exceed presumptive listing levels. (EDF, 00036)

**Response:** After reviewing all of the public comments, the risk assessment was modified to address those comments which the Agency agreed had merit and could be addressed by currently available risk assessment tools. These revisions are described in the April 8, 1997 NODA and today's docket. The re-analysis showed that the non-groundwater risk does not exceed  $4 \times 10^{-7}$ .

The revised modeling completed by EPA in response to comments on the proposal and the NODA included a full sensitivity analysis to determine the most critical high-end parameters, and resulted in off-site landfill groundwater risks increasing to 3E-5 (see "Additional Groundwater Pathway Analyses," 1998). The high-end risk was lowered slightly to 2E-5 in the TC-capped results. However, the revised Monte Carlo risk, 6E-6, is below EPA's level of concern (1E-5), and the TC-capped Monte Carlo risks drop to 2E-6, suggesting the TC may control most risks of concern for this waste. After considering these risk results, and the other factors discussed below, EPA finds that the listing of this waste is not warranted.

First, while the levels of benzene in the waste and TCLP samples are of potential concern, the toxicity characteristic for benzene should provide some measure of control of wastes with high benzene levels. Nearly 40% (52) of the 141 unleaded gasoline tank sediment wastes streams generated in 1992 were reported in the RCRA 3007 Questionnaire to be coded as hazardous waste (due primarily to the TC for benzene, and occasionally for ignitability). While EPA's risk analysis using TCLP input data capped at the TC level still showed some risk (2E-05), many of the wastes that are not TC-hazardous will likely have benzene levels below the TC level. Thus, given the existing regulatory control afforded by the TC, the incremental benefit to listing this waste appears limited.

Furthermore, this waste does not have the features that EPA found compelling in deciding to list other wastes examined in this rule. Specifically, this waste lacks the pyrophoricity and arsenic concerns exhibited by the spent catalysts and it has low oil content and PAH levels compared to the crude oil and CSO tank sediments. The oil content of this waste is typically low as evidenced by the median TOG levels reported in the Questionnaire (6%), and samples taken by EPA (<1%). This contrasts with much higher TOG levels in crude oil storage tank sediment (34% average from the Questionnaire, and 21% average from the six samples EPA analyzed) and CSO tank sediment (Questionnaire average, 30%, sample average 37%). EPA's analyses of samples of unleaded gasoline storage tank sediments also showed none of the carcinogenic PAHs that were of concern in sediment from CSO and crude oil tanks were detected. For example, average benzo(a)pyrene levels found in sediment from CSO and crude oil storage were 132 ppm and 12 respectively, but none was found in sediment from unleaded gasoline storage. In addition, one of the major constituents measured in the unleaded gasoline tank sediment was iron (e.g., the average iron level for the three samples was 41%), thus this waste appears to be largely rust and scale, rather than the higher organic content of the other tank sediments. Therefore, EPA is more confident that the other constituents of gasoline tank sediment will not present any potential problem.

Also, as noted in the proposed rule, the total volume of the waste reported for 1992 is relatively small (3,583 MT), and the volumes sent to landfills are even smaller (633 MT, 22 MT average per wastestream). These volumes are significantly smaller than the volumes of crude oil storage tank sediment generated (22,017 MT) and sent to landfills (2,338 MT, 123 MT average).

Finally, EPA has promulgated regulations under the Clean Air Act that will result in the reduction

of benzene levels in gasoline (see the Reformulated Gasoline Rule, February 16, 1994; 59 FR 7716). This rule sets a 1.0% (vol.) limit on reformulated gasoline for non-attainment areas of the U.S. In conventional gasoline, benzene is incorporated into gasoline to increase the octane rating, and the average amount of benzene in conventional gasoline is 1.6% , ranging up to 5.0%. Therefore, as the levels of benzene in gasoline are reduced, sediment from storage of gasoline should also show a corresponding reduction in the levels of benzene. This will reduce the potential groundwater risks resulting from benzene in unleaded gasoline storage tank sediment.

**Comment 13:** The average total concentration of benzene in unleaded gasoline storage tank sludge exceeds the comparable concentrations in F037 and F038 that caused those wastes to be listed in 1990. (EDF, 00036)

**Response:** EPA recognizes that this and other residuals characterized in this listing determination contain concentrations of toxicants equal to or greater than previously listed wastes, including the F037 and F038 refinery residuals. Direct comparison of these concentrations to previous listing benchmarks is not an adequate basis for listing given the significant advances in the Agency's risk assessment expertise. See also EPA's response to Comment 14 in Section IV.A.5 of this response to comment document, above.

Thus, while the unleaded gasoline storage tank sediment benzene concentrations may be greater than corresponding concentrations in F037/F038 sludges, EPA has applied its current (and more precise) risk assessment methodology, carefully considering the likely waste management practices for this residual, among other factors, and determined that the data supports a no list finding.

**Comment 14:** It is patently absurd for EPA on the one hand to acknowledge in a series of rulemakings that the TCLP is ineffective on oily wastes, and on the other hand contend in this rulemaking that the toxicity characteristic based upon TCLP results would adequately capture sludges containing 20% oil and grease. The fact that only one of three EPA samples exhibited the toxicity characteristic (using the TCLP) confirms the ineffectiveness of the procedure on oily wastes. (EDF, 00036)

**Response:** EPA was able to conduct oil and grease analyses on two of the three samples collected during the field investigation (as discussed in response to comment 3 of this section). Insufficient sample volume remained of the third archived sample to support this analysis. One of the two samples contained 0.09 percent oil and grease, while the second had non-detectable levels. These results are in keeping with EPA's expectations for this residual, that is, organic levels are reduced due to the waterwashing used by refineries to minimize benzene and ignition risks when the storage tank is opened for inspection and sludge removal.

In general, therefore, EPA believes that the commenter's concern is overstated, and that this residual is generally not oily in the manner anticipated by the commenter.

**Comment 15:** Even at risk levels within the  $10^{-4}$  to  $10^{-6}$  risk range, unleaded gasoline storage tank sludge warrants listing as a hazardous waste based upon the factors EPA considers under its listing determination policy when risks from improper waste management fall in that range. First, the waste characterization is extremely uncertain since it substantially understates the risks posed by unleaded gasoline storage tank sludge insofar as TCLP results are used. Second, the risk assessment is also extremely uncertain because it vastly underestimates potential risks due to unsupported assumptions regarding management practices and the failure to consider important exposure pathways and population receptors. Third, EPA completely failed to consider co-occurrence or co-disposal with other wastes, and the resulting aggregation of constituents and potential for free phase flow. Fourth, other regulatory programs will not address the risks posed by the mismanagement of these wastes. (EDF, 00036)

**Response:** The EPA has considered each of the commenter's four arguments claiming that EPA's risk assessment and decision making understates the potential hazards associated with unleaded gasoline tank sludge. The Agency's specific responses are provided below in Comments 15a through 15d. After evaluating each of these factors, as well as the other factors listed in EPA's listing determination policy, EPA has concluded that the weight of evidence for unleaded gasoline tank sludge demonstrates that this residual does not merit listing as a hazardous waste and that the Toxicity Characteristic provides adequate regulatory control over those residual that do contain elevated levels of benzene.

**Comment 15a:** The waste characterization is extremely uncertain since it substantially understates the risks posed by unleaded gasoline storage tank sludge insofar as TCLP results are used. (EDF, 00036)

**Response:** As discussed above (see responses to Comments 3 and 5 in this section), EPA disagrees with the commenter regarding the uncertainty associated with the TCLP results. The Agency stands by the validity of the analytical results.

**Comment 15b:** The risk assessment is extremely uncertain because it vastly underestimates potential risks due to unsupported assumptions regarding management practices and the failure to consider important exposure pathways and population receptors. (EDF, 00036)

**Response:** As described above (see response to Comment 2 in this section), EPA disagrees that there is a need to model landfill cover as a scenario of concern for this residual. Other risk assessment assumptions of concern to the commenter are addressed in response to Comment 1 above. The Agency agrees that there is uncertainty associated with the results of the risk assessment. EPA completed a Monte Carlo analyses of the groundwater pathway and the results suggest that the risks for this waste are not significant. Specifically, the revised groundwater results for offsite landfills showed a 95th percentile risk of  $6E-6$  for this waste, below EPA's  $1E-5$  level of concern. An uncertainty and variability analysis has also been performed in support of the nongroundwater risk assessment for this rule. A detailed discussion of the qualitative and quantitative aspects of this analysis are presented in the Uncertainty Analysis: NonGroundwater

Pathway Risk Assessment (1998). EPA has concluded that the risk assessment provides a reasonable measure of risk and that uncertainty levels are acceptable.

**Comment 15c:** EPA completely failed to consider co-occurrence or co-disposal with other wastes, and the resulting aggregation of constituents and potential for free phase flow. (EDF, 00036)

**Response:** As described in the April NODA, EPA has conducted a full assessment of co-disposal with other refinery wastes and continues to find that the risks associated with this residual do not warrant listing.

**Comment 15d:** Other regulatory programs will not address the risks posed by the mismanagement of these wastes. (EDF, 00036)

**Response:** EPA does not believe the potential risks for this waste merit listing. Concerning other regulatory programs, EPA continues to believe that the primary source of risk associated with this waste is benzene and refineries are subject to extensive benzene controls already through the Benzene NESHAPs and the toxicity characteristic for benzene. Thus, these other regulations will, in fact, provide additional controls for any potential benzene risks.

3. Applicability of the TC: The Agency requested specific comments on whether the fact that the TC effectively captures unleaded gasoline storage tank sediments with high benzene concentrations should be used as the basis for a no-list determination for this waste.

**Comment 1:** The commenter contends that the fact that unleaded gasoline tank sediment may exhibit the TC strongly suggests that existing safeguards such as the TC rule are working to protect human health and the environment. The TC test does identify those residual streams that are potentially hazardous while allowing more cost-effective disposal for those residuals which are not deemed to be hazardous. This is a *Common Sense* approach to protecting human health and the environment that should be endorsed, not used as an excuse to list all Unleaded Tank Sediment. (Mobil, 00033)

**Response:** The Agency acknowledges the commenter's response. While the toxicity characteristic does provide protection for those residuals with high leachable benzene levels, EPA's risk assessment found that this waste did not exhibit high enough risk levels (in conjunction with other factors noted) to support a positive listing determination.

## **L. CATALYST FROM REFORMING**

1. General

**Comment 1:** The commenter agrees with EPA that no significant risks are posed by the



management of this residual. Since this residual is extremely valuable due to the presence of platinum, a precious metal, this residual is not managed as a waste. (Sun, 00034)

**Response:** EPA acknowledges the commenter's support.

**Comment 2:** The commenter believes that the in-situ regeneration of this residual is part of the normal operation of a refinery and should not be considered a waste management activity or be subject to RCRA. It is only when catalyst regeneration can no longer continue the active life of the catalyst and the catalyst must be removed from the process, that the residual could become classified as a solid waste. (Sun, 00034)

**Response:** Catalyst which is regenerated in-situ (i.e., has not left the petroleum refining process) is not a solid waste and the regeneration process is not a waste management activity. However, if the catalyst is removed from the refinery process for regeneration in another process or unit, the catalyst is a solid waste.

2. Sludge Data: The Agency specifically requested data on API separator sludge and other oil-bearing wastes that come into contact with discarded caustic scrubber waters from the regeneration of precious metal catalysts in the reforming process.

**Comment 1:** The limited data set collected in 1989 seems to indicate the presence of extremely small quantities of dioxins/furans in the catalytic reformer regeneration caustic neutralization effluent (operated for corrosion control) from semi-regenerative reformer units. However, it is evident that there is extreme variability in these dioxin data and the cause and reasons for this variability are not as yet understood. For this reason, meaningful projections based on these data are really not feasible. (API, 00046; Mobil, 00033)

**Response:** The commenters were unable to provide additional data. As noted in the proposed rule, the data set suggests that the dioxins and furans may concentrate in wastewater treatment sludges generated during catalyst regeneration at facilities using the semi-regenerative process. However, the Agency lacks adequate data during periods of operation prior to the regeneration cycles. One sample obtained at refinery A which used the cyclic process exhibited no detectable dioxins prior to regeneration. Therefore, concentrations of dioxins in such sludges may be lower during other periods of operation (e.g., non-regeneration). At this time the Agency concludes there are not sufficient data to indicate that the dioxin content in sludges presents a significant problem. In addition to the above sludge data, data results from dioxin analyses on regeneration wastewaters from refineries located in the U.S. and Canada indicated the presence of dioxin at low levels. This information is presented in "Preliminary Data Summary for the Petroleum Refinery Category", April, 1996.

**Comment 2:** EPA's analyses of these primary sludges are very inconsistent. One location, with a cyclic reformer, showed no dioxins/furans, but had discharged no caustic neutralization effluent to the refinery effluent sewer system during the regeneration sampling procedure. This suggests that

there are unlikely to be other sources of dioxins/furans in its primary sludge. At a second location, with a semi-regenerative reformer, EPA obtained a grab sample, which was analyzed to contain approximately 50 TEQ ppt. Finally, at a third location, EPA obtained a composite primary sludge sample obtained over the full regeneration period and analyzed with a result of 11 TEQ ppt. These three samples constitute EPA's entire data base on dioxins/furans in primary sludge. The lower result from the composite sample would seem to be a more reliable indicator, since it was collected in a more scientific manner. However, even this lower result is suspect due to the inherently complex matrix interferences that can render analyses of this kind of multi-phase material very difficult. Primary sludges are mixtures of solids, water, hydrocarbon, and emulsion. Accurate analysis of the parts per trillion range is extremely difficult and generally, not very reliable. Given the aforementioned matrix interferences, it is not possible to claim that either result is the correct one, or even that either result is correct. Rather, the point is that such analysis simply is too variable and unreliable a basis to form any significant conclusions relative to the concentration of extremely small quantities of dioxins/furans in primary sludge during semi-regenerative reformer regeneration events, or to extrapolate such results to refineries that operate cyclic or continuous reformers. (API, 00046; Mobil, 00033; Valero, 00051; NPRA, 00015)

**Response:** See response to comment 1 in this section. Oil-bearing samples do present a complex matrix for analysis. However, the analysis of dioxin/furans using isotope dilution techniques and high resolution gas chromatograph/mass spectrometer is a very robust method capable of the highly selective measurement of the analytes of interest even in such complex matrixes. The Agency finds no reason to suspect the measurements (nor did the commenter provide any concrete basis to question the analytical data gathered) and believes the measurements clearly show the presence of dioxin/furans in some sludge samples.

The Agency has no sludge data from the 23 facilities that operate continuous reformers. Because these facilities do not use caustic scrubbers during regeneration, the Agency has no reason to believe that the sludges produced at these facilities could be similarly contaminated with dioxin/furans.

**Comment 3:** As a practical matter, the limited 1989 data set does not provide sufficiently reliable enough data on which to draw any scientific conclusions. A much more comprehensive sampling and composition program would be required to reveal a reliable pattern of dioxin/furan contamination. A cursory inspection of the 1989 data set reveals troubling and unexplained inconsistencies between results. Only one of the two data sets reveals even extremely small quantities of 2,3,7,8-TCDD in caustic neutralization effluent, while the other was virtually non-detect for both 2,3,7,8-TCDD and 2,3,7,8-TCDF. All three of the refineries where primary sludges were sampled were non-detect for 2,3,7,8-TCDD, and the results for 2,3,7,8-TCDF are so inconsistent as to at least raise questions of reliability. The TEQs quoted by EPA for primary sludges are derived from the highly chlorinated PCDDs and PCDFs, which are much lower in toxicity and bioaccumulation potential than 2,3,7,8-TCDD. (API, 00046; Mobil, 00033)

**Response:** The mechanism leading to the formation of dioxins in the regeneration process is not

well defined and is further complicated by the use of various chlorine source chemicals and regeneration conditions. The data set is simply too small to reliably discount the presence of any isomer found at one facility and not at another.

**Comment 4:** It seems vastly premature to conclude that there is any significant dioxin issue associated with refinery reformer regenerations. Rather, the limited data available already strongly suggest that the Agency's focus on potential dioxin releases would be more likely to provide enhanced protection of human health and the environment if it focused on some of the known, more substantive dioxin release contributors rather than the apparently very small potential dioxins/furans contribution from refinery reformer regeneration events. (API, 00046; Mobil, 00033)

**Response:** Although the amount of dioxin/furans that are accumulated in oil sludges may be small relative to the amount produced by medical and municipal waste incineration, the Agency remains concerned with any potential source of dioxins and furans as these materials can highly bioconcentrate.

**Comment 5:** The commenter has not found it necessary to analyze any of the primary sludges that EPA cites (K048, K051, F037, or F038) for dioxin/furan content. Other than the very limited and unreliable data generated by the 1989 EPA sampling, which was not reported by EPA until 1994, the commenter has had no reason to believe that these wastes typically contain measurable quantities of dioxins/furans and has not gone to the very considerable expense that such an analysis entails in order to attempt to prove a negative. Consequently, the commenter cannot provide any other data that would provide new information on possible dioxin content of primary sludges either during reformer regenerations or during normal typical refinery operation. (Mobil, 00033)

**Response:** The Agency is well aware of the cost of such sampling and analysis.

**Comment 6:** Any regulation proposed by EPA must demonstrate the impact of these very minute quantities of dioxin/furan on human health and the environment. (Valero, 00051; NPRA, 00015)

**Response:** The Agency has not proposed any additional regulation of oil/water/separator sludges. The Agency does not have sufficient data at this time to project any significant environmental impacts.

3. Other Sludges: The Agency requested additional data on the dioxin/furan content of similar sludges, especially sludges generated during normal operations when regeneration is not occurring and those sludges generated by facilities using a continuous reforming process that does not produce caustic scrubber waters.

**Comment 1:** Past studies have shown the presence of dioxins and furans at some refineries in their alkaline rinse water from reformer units after the catalyst after it is "chlorided." The level of

these compounds is in the *parts per trillion (ppt)* range and below. When these rinse waters commingle with the refinery wastewater, these extremely low levels are further diluted many times over. While it is difficult to imagine that these compounds at these concentrations could pose significant risk to human health and the environment, this issue should be addressed separately from this current rulemaking. (ARCO, 00054)

**Response:** No additional data was provided. If necessary, this issue may be further addressed in separate rulemakings regarding effluent guidelines or air emissions during catalyst regeneration.

4. Dioxin Removal: The Agency requested information about potential opportunities for removing dioxin prior to discharge of scrubber water into the wastewater treatment system.

**Comment 1:** The use of activated carbon is an accepted method for removal of dioxins and furans from caustic effluent streams. Activated carbon systems have been employed in Canada since 1988. However, such a system would be expensive to install and operate and cannot be justified by the very limited and questionable data available showing only trace quantities of dioxins being routed to refinery wastewater treatment. Moreover, while carbon treatment is used in Canada, Canadian regulations allow disposal of the contaminated activated carbon in landfills. In the United States, activated carbon vendors will not accept dioxin contaminated activated carbon for regeneration and disposal in landfills would likely be precluded, increasing the operating cost of such systems and raising questions about the adequacy of alternate incinerator capacity capable of handling dioxin contaminated wastes. Refinery wastewater treatment effluent from the 1989 EPA survey indicates that no dioxins have been detected at the refinery outfall, so the dioxin issue does not raise a human health concern with respect to discharges to waters of the United States. (API, 00046; Mobil, 00033)

**Response:** EPA notes that activated carbon treatment should not be expensive to install or operate. Regeneration process wastewaters could be collected and isolated in a holding tank, and a relatively small carbon treatment system could be employed. Since this wastewater is low in organic content, the life of the carbon should be long (perhaps several years). However, EPA agrees that disposal and/or regeneration of spent carbon would remain a problem.

5. Segregation of Scrubber Water: The Agency requested information about potential opportunities to segregate scrubber waters.

**Comment 1:** EPA's request in this regard is unclear. The neutralization effluent is typically segregated at its point of generation. It is then discharged to the refinery sewer, often on a controlled basis to help adjust system pH. Thus, while the hypothetical potential exists to segregate the material, in general facilities do not do so. Maintaining segregation to allow treatment through activated carbon canisters would require installation of some temporary storage equipment as well as the treatment facilities. If alternate forms of treatment were required that resulted in segregation and overhaul for third party treatment, very significant and costly storage

and handling facilities would be needed. The availability, nature, and cost of such off-site treatment are unknown. (API, 00046; Mobil, 00033)

**Response:** The Agency's request was to gain insight as to feasibility of isolating caustic scrubber water from the wastewater treatment system so that sludges would not become contaminated with the dioxins/furans contained in the scrubber waters. The Agency thanks the commenters for the information provided.

6. Recycle to Coker Risks: The Agency requested information regarding the potential health risks associated with inserting dioxin-containing media into the refining process (e.g., coker).

**Comment 1:** The fate of any extremely small quantity/concentration of dioxins/furans that are further concentrated in oil bearing solids recovered from refinery sewers is not known. Beyond the 1989 sampling event data, the commenter has no data indicating the presence of extremely small concentrations of dioxins in any media recycled to the coker or in any other products from the coker. (API, 00046)

**Response:** The Agency acknowledges the commenter's input.

**Comment 2:** Although the current database is severely limited in size, the likelihood of any such health risk seems extremely remote given the indication that the extent of contamination is extremely small in the first instance. Even if one accepts that this very limited data suggests some potential for contamination during semi-regenerative reformer regeneration events, the fact is that such regenerations occur infrequently, perhaps an average of 1.5 times per year for 3-5 days. This suggests that the potential only exists for 5-8 days per year, if at all. If media that is reprocessed in the refinery (on the coker or otherwise) was contaminated during those 5-8 days, it would be further diluted by whatever reprocessing step was involved.

Data from refinery cyclic reformers are even more limited with only one 1989 data point (where no caustic neutralization effluent was introduced into the sewer, so no mechanism for transference of contamination existed) and the single 1995 data point not yet publicly reported. Because cyclic reformers often conduct regenerations on a portion of the catalyst on a continuing basis, there is a possibility of greater dioxin contribution from such units. However, with the variability evidenced by the semi-regenerative data, it would be extremely premature to draw any conclusions about cyclic reformers based on one, as yet, unreported sample event. The third type of reformer, continuous reforming, has yet to be sampled.

The fate of any extremely small quantity/concentration of dioxins/furans that are further concentrated in oil bearing solids recovered from refinery sewers is not known. Beyond the 1989 sampling event data, the commenter has no data indicating the presence of extremely small concentrations of dioxins in any media recycled to the coker or in any products from the coker. (Mobil, 00033)

**Response:** The Agency acknowledges the commenter's input.

#### **M. SLUDGE FROM SULFURIC ACID ALKYLATION**

**Comment 1:** The commenter agrees with the EPA that this residual is a minor refinery residual that does not pose risks that require listing. (Sun, 00034)

**Response:** EPA acknowledges the commenter's support.

The Agency requested additional waste characterization data on sludge from sulfuric acid alkylation, as well as comments on the proposed decision not to list sulfuric acid alkylation sludge but to regulate this waste within the existing framework of characteristic wastes.

No specific comments or data were submitted.